HEA-NZEB designs for primary schools in Delhi

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Introduction

Adequate Indoor Air Quality (IAQ) and thermal comfort in schools is of major concern in relation to health, especially in an emerging economy such as India. In India this issue is caused by both the extreme climate, bad outdoor air quality, and economical and cultural aspects, causing children to develop chronic repository diseases (CPCB, 2008). Therefore, this project was defined to help improve the indoor climate/health in Indian governmental primary schools.

Problem Description

Currently, the indoor climate in existing primary schools in Delhi is polluted and uncomfortable. This issue needs to be improved in a sustainable energy efficient way. Current situation is mainly caused by:

- Highly polluted outdoor air
- Extreme climate
- Unreliable electricity net

Research Question

How can modular improvement packages help primary schools I Delhi move towards a healthier indoor climate in an energy efficient?

1. *To what extent is it feasible to improve the indoor climate quantitatively?*
2. *To what extent can the solutions reach a nearly zero energy design?*

Objective

The main objective of the project is to develop modular improvement packages for existing Indian primary schools that aim at low energy buildings and improved indoor climate. These packages involve both architectural (building physics) measures, installation (HVAC) measures, and on site energy production. The central idea is develop a plug and play solution that can be used when renovating existing primary schools in such a way that they become HEAlthy Nearly Zero Energy Buildings or HEA-NZEBs.

CPCB, Study on ambient air quality, respiratory symptoms and lung function of children in Delhi," tech. rep., Central Pollution Control Board, Delhi, 2008

The design solutions are evaluated based on indoor climate/health, energy efficiency and indicative costs: see the triangular scheme in Figure 1.

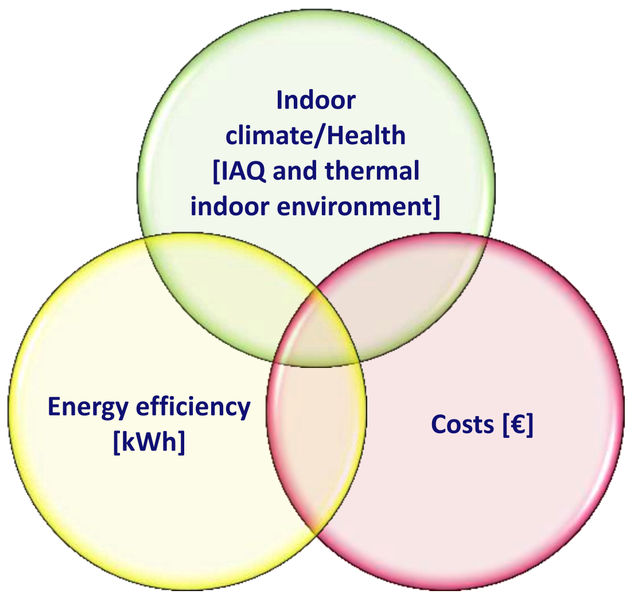

Figure 1 Triangular scheme of the design aspects: indoor air quality, energy efficiency, and investments costs.

IAQ; The Particulate Matter (PM) and the CO2 level are quantified and tested to the ISHRAE standards.
Thermal indoor environment; Overall the indoor thermal comfort is determined, the focus will be on the apparent indoor temperature in summer.
Energy use; The energy use per classroom [kWh] is evaluated on the sustainability of the source.
Feasibility; The solutions must be as financially feasible as possible.

Methodology