Global Air Conditioning Performance Indicator (ACPI) for buildings, in tropical climate

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Abstract

The selection of the most suitable HVAC technology for buildings, is a complex challenge. Many factors such as, the features of the building, climatic conditions, energy consumption, Indoor Air Quality (IAQ), thermal comfort, regulations, aspects, economic and environmental aspects, all of which are shown on a local and national scope. There is no standard methodology that guarantees a single criterion for the selection of HVAC systems. Therefore, in its solution, as in almost all decision-making problems in the field of engineering, two different aspects are considered, theoretical and practical (Moreno, 2002) [1], thus forming a typical multi-criteria decision problem. This study proposes an integral performance indicator for the selection of air conditioning systems (ACPI), based on the multicriteria method of the Analytic Hierarchy Process (AHP), in order to choose the best HVAC system variant, based on its classification by integrating energy, environmental, and economic criteria. For the definition of the criteria, studies on HVAC system selection were reviewed and classified, applying multi-criteria on methods. The criteria were weighted based on surveys issued by a team made up of Professors/Researchers, architects, engineers, installers and managers linked to the HVAC sector. The ACPI model obtained, shows that the highest weighting corresponds to building energy consumption index 26.6%, IAQ 20.6%, thermal comfort 18.6%, CO2 emissions 12.1%, and finally, investment costs, operation and maintenance costs 11.6% and 10.3% respectively. The proposed ACPI, together with its analysis methodology, will allow researchers, architects, engineers, and government administration, to consider a wide range of alternative HVAC systems applied in buildings. With this, it will be possible to select them based on a decision-making model with a reliable source of information.

Keywords
Performance indicator, Multi-criteria analysis, AHP, Air-conditioning, Tropical climate