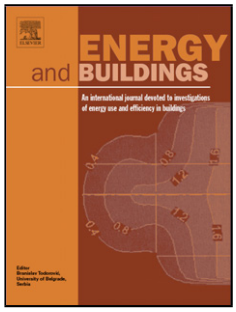

Title: Using a passive design toolset to evaluate low-cost cooling strategies for an industrial facility in a hot and dry climate

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Using a passive design toolset to evaluate low-cost cooling strategies for an industrial facility in a hot and dry climate

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This study outlines the energy saving potential of natural cooling design strategies in a large maintenance hangar facility located in Boise Idaho, USA. A new series of climate-based design tools for calculating energy savings were developed to evaluate the feasibility and potential effectiveness of natural ventilation systems. Based on the building's heat gains, these tools estimated the required cooling capacity. Results indicate that 43% of occupied-only periods between shoulder seasons (May and September) have the potential to obtain free cooling from the outdoor air via natural ventilation strategies. The research included a comparison of the Climate Design Toolset with advanced energy simulation methods. This comparison built confidence in the tools and in some cases brought attention to areas that require caution when implementing them. The validity analysis represents the hand calculations which produced similar results compared to the simulation at an acceptable level of confidence for early design analysis.

Keywords: Natural cooling design strategies; research-based energy savings calculator tools; high performance sustainable industrial buildings; aircraft hangar facility; night flush cooling; stack ventilation.

1. Introduction

During the last few decades, the rapid development of the aviation industry has led to a sharp rise in the construction of large maintenance hangar facilities [1]. Hangars are a special-use type of industrial property with unique characteristics. These characteristics include a large volume of air inside the building, an exposed location, high ceilings, and low occupant density. Due to these characteristics, hangar facilities have never been easy to cool or heat. Demand for cooling has grown substantially due to increases of