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Patent Search

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Abstract:

The present disclosure relates to sustainable building technology and passive cooling systems, and provides an earth air tunnel system (100) configured to utilize the stable temperature of the subsoil to pre-cool or pre-heat ventilation air, thereby reducing reliance on energy-intensive mechanical systems. The earth air tunnel system includes an underground pipe network (104) disposed at a pipe burial depth (106) of about two to four meters within a stable subsoil temperature zone (114), a blow regulated air circulation, an air intake unit (102), and an outlet duct (112) delivering thermally conditioned air to a building interior. The earth air tunnel system (100) continuously to provide passive cooling and heating, thereby reducing energy consumption, operating cost, and environmental impact while offering long service life maintenance.

Complete Specification

Description: TECHNICAL FIELD

[001] The present invention relates to sustainable building technology and passive cooling systems, and more particularly to a DESIGN AND PERFORMANCE EVALUATION of an Earth Air Tunnel system utilizing geothermal energy through underground pipes to exchange heat between ambient air and relatively constant subsoil temperature for energy-efficient building thermal management.

BACKGROUND

[002] The field of sustainable building technology and passive cooling systems has seen significant development in recent years, driven by escalating global energy prices and mounting environmental concerns. Space heating and cooling for residential, commercial, and institutional buildings collectively account for nearly one-third of primary energy consumption worldwide. Conventional heating, ventilation, and air-conditioning systems typically rely on mechanical refrigeration cycles powered by fossil fuel-derived electricity, placing considerable pressure on non-renewable resources and contributing substantially to greenhouse gas emissions. As urbanization intensifies and climate patterns become more extreme, the thermal conditioning load imposed on buildings may continue to increase, rendering conventional approaches increasingly unsustainable from both an economic and an environmental perspective.

[003] Passive and renewable energy-based thermal conditioning techniques have attracted considerable research attention as alternatives to conventional mechanical systems. Among such techniques, ground-coupled heat exchange exploits the thermally stable characteristics of the subsoil at moderate depths to pre-condition air before it enters a building. At depths typically ranging from about two meters to about four meters, soil temperature remains substantially constant throughout the year, largely unaffected by seasonal surface temperature fluctuations. This thermal stability arises from the high thermal mass of the earth and the damping effect

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