

Thermal Regulation and Energy Saving Benefits of Greenery Recommendation Compliance with Common Tree Species in Hong Kong.

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Abstract

Using validated ENVI-met model simulation, parametric study was conducted for a selected neighborhood in Hong Kong to investigate the thermal regulation and energy saving benefits of greening under its current (~7%) Green Coverage Ratio, GCR and if the 30% GCR recommended by the Local Government is complied with. Furthermore, in a bid to provide information for efficient tree species selection, nine (9) scenarios was tested for case with 30% GCR, of which each of the first eight (8) is absolutely composed of one of the eight (8) most common Hong Kong's tree species and one, a mix of trees species based on urban density selection method.

Results revealed maximum temperature reduction of 0.4°C and 0.5 – 1.0°C with current and 30% GCR compliance, respectively. In terms of thermal comfort, average Physiological Equivalent Temperature (PET) reduced by 1.6°C and 3.3 – 5.0°C with current and 30% GCR compliance, respectively. Besides, area coverage of “Very Hot” thermal sensation reduced from ~60% in reference case to ~50% with current GCR and 17 – 21% with 30% GCR. Lastly, cooling energy saving of 1500 kWh was observed with the current GCR which increased to ~1900 – 3000 kWh per typical summer day with 30% GCR. The latter is equivalent to 200 – 450US\$ savings within the 500m² domain. Variations of estimated benefits between scenarios with 30% GCR emphasizes the role of tree species (i.e. morphological configuration); statistical analysis results revealed leaf area index as the main driver of the observed thermal and energy-saving benefits followed by trunk height, tree height and crown diameter. Findings from this study will inform city planners, estate developers and citizens on the thermal benefit of adhering to the government's regulations on tree-planting thereby aiding improved action for implementation.

Keywords: Temperature regulation, energy saving, thermal comfort, tree species, ENVI-met