

ABSTRACT

The seriousness of environmental degradation, global warming, and the energy crisis triggered the development of a new construction industry concept in the application of environmentally friendly technologies. The concept is embodied in the construction process called green construction with its main product called green building. The concept of green building emphasis on optimizing energy consumption, especially in the governance of electrical energy, HVAC systems, lighting systems, water resource management, and the selection of materials. Nevertheless, the audit process and certification of buildings both of the green building and a conventional building is not widely practiced. It had never done a comparative analysis between green building and a conventional building that would clarify the public perception and growing up a constructive awareness for efficiency and conservation, especially in relation to energy consumption.

This study develop a comparative analysis of the energy consumption in green building and conventional building by case studies; Main Building of The Ministry of Public Works (Kementerian Pekerjaan Umum or simply PU) and Operational Building of The Indonesian Agency for Meteorological, Climatological and Geophysics (Badan Meteorologi, Klimatologi, dan Geofisika or simply BMKG). This study focuses on 5 (five) main variables as follows; measurement of air temperature and relative humidity, the calculation of Overall Transfer Thermal Value (OTTV) and Roof Transfer Thermal Value (RTTV), the calculation of the Energy Consumption Intensity (ECI) for both of air conditioning and non air-conditioning area, the calculation of water consumption and the analysis of building's life cycle cost .

The results of the study showed that green building has several excellences over conventional buildings. In the measurement of temperature and relative humidity, PU = 29.47/61.37% while BMKG = 31.20/62.48%. In the OTTV and RTTV calculation PU = 28.778 W/m² and BMKG = 48.684 W/m². Energy Consumption Intensity (ECI) calculation for air-conditioned room, PU = Efficient - Very Efficient (6.75 to 7.70 kWh/m²) and BMKG = Inefficient (18.99 to 19.04 kWh/m²), for non air-conditioned room, PU = Efficient (0.849 to 0.856 kWh/m²), and BMKG = Quite Efficient (2.110 to 2.116 kWh/m²). Calculation of water consumption, PU = 28.83 to 36.50 liters/people/day while BMKG = 42.27 to 61.51 liters/people/day.. Calculation of life-cycle cost analysis, in the 40th year the total value of the BMKG building is IDR 2.103.819.021.000, 00 or reaches 175 % of the total value of the PU building which is IDR 1.224.129.196.000, 00.

Keyword : green building, conventional building, energy consumption, efficiency

INTISARI

Semakin parahnya kerusakan lingkungan, fenomena *global warming*, dan terjadinya krisis energi memicu dikembangkannya konsep baru dalam industri konstruksi berupa aplikasi teknologi yang ramah lingkungan. Konsep tersebut mewujudkan dalam proses konstruksi yang disebut *green construction* dengan produk utama yang disebut *green building*. Konsep *green building* menekankan pada optimalisasi dan efisiensi tingkat konsumsi energi terutama dalam tata kelola energi listrik, sistem penghawaan, sistem tata cahaya, pengelolaan sumber daya air, dan pemilihan material. Namun, proses audit dan sertifikasi bangunan gedung masih belum banyak dilakukan. Belum banyak diketahui sejauh mana penerapan konsep *green building* pada bangunan-bangunan gedung di Indonesia, sehingga perlu dilakukan suatu analisis perbandingan yang akan memperjelas persepsi masyarakat tentang *green building* dan menumbuhkan kesadaran konstruktif untuk melakukan efisiensi dan konservasi terutama dalam hal konsumsi energi.

Penelitian ini mengangkat suatu analisis perbandingan konsumsi energi pada bangunan gedung dengan konsep *green building* dan bangunan gedung konvensional dengan studi kasus Gedung Utama Kementerian Pekerjaan Umum dan Gedung Operasional Utama Badan Meteorologi Klimatologi dan Geofisika (BMKG). Penelitian menitikberatkan pada 5 (lima) variabel utama efisiensi energi yaitu; pengukuran suhu dan kelembaban relatif udara, perhitungan nilai perpindahan panas melalui selubung bangunan dan perpindahan panas melalui atap (OTTV-RTTV), perhitungan Intensitas Konsumsi Energi (IKE) untuk ruangan ber AC dan non AC, perhitungan konsumsi air, dan perbandingan komponen biaya operasional dan pemeliharaan melalui analisis *life cycle cost* (biaya daur hidup bangunan).

Hasil dari penelitian menunjukkan bahwa bangunan *green building* memiliki beberapa keunggulan dibanding bangunan konvensional. Pada perhitungan suhu dan kelembaban relatif udara, gedung PU = 29,47/61,37% dan gedung BMKG = 31,20/62,48%. Perhitungan nilai OTTV dan RTTV, gedung PU = 28,778 W/m², dan BMKG = 48,684 W/m². Perhitungan IKE Netto untuk ruang ber-AC, gedung PU = Efisien-Sangat Efisien (6,75-7,70 kWh/m²) dan BMKG = Agak Boros (18,99-19,04 kWh/m²), untuk ruang non-AC, PU = Efisien (0,849-0,856 kWh/m²), dan BMKG = Cukup Efisien (2,110-2,116 kWh/m²). Perhitungan konsumsi air, gedung PU = 28,83 s.d 36,50 liter/org/hari sedangkan BMKG = 42,27 s.d 61,51 liter/org/hari. Perhitungan analisis *life cycle cost* (biaya daur hidup); pada tahun ke-40 nilai total pada gedung BMKG adalah Rp. 2.103.819.021.000, 00 atau mencapai 175% dari nilai total pada gedung PU sebesar Rp. 1.224.129.196.000, 00.

Kata kunci : *green building*, bangunan konvensional, konsumsi energi, efisiensi