INTISARI

Sektor konstruksi menimbulkan potensi dampak perubahan iklim sejak penyediaan bahan baku, produksi material, hingga pengangkutan ke lokasi proyek. Hal tersebut relevan pada Pavilion 120 di PIK2 karena struktur atasnya menggunakan kombinasi glulam meranti, *cross-laminated timber* (CLT) jabon merah, baja, beton bertulang, komponen sambungan, dan bahan pendukung dengan proses produksi serta rantai pasok yang berbeda. Penelitian ini bertujuan menyusun inventori daur hidup, menghitung potensi dampak perubahan iklim, dan mengidentifikasi kontribusi material, produksi, transportasi, serta karbon biogenik pada struktur atas Pavilion 120.

Penelitian dilakukan sebagai studi kasus kuantitatif menggunakan *Life Cycle Assessment* atribusional berbasis proses dengan batas *cradle-to-site* yang mencakup modul A1–A4 dan aliran acuan satu *item* struktur atas Pavilion 120. Kuantitas glulam, CLT, profil baja, dan beton diperoleh melalui *quantity take-off* model Revit, sedangkan pelat sambungan, pengencang, tulangan, pengelasan, resin, dan perekat dikuantifikasi dari gambar DED, dokumen proyek, serta perhitungan manual. Aktivitas transportasi dihitung per ruas berdasarkan massa muatan, jarak, dan moda dalam satuan ton-kilometer. Inventori proyek dihubungkan dengan *dataset* BAFU-2026 v1 dan proses kustom untuk glulam, CLT, beton K350, pengencang, pengelasan, serta *chemical anchor resin*. *Product system* dimodelkan dalam openLCA 2.6.2 dan dikarakterisasi menggunakan metode IPCC 2021 (ISO 14067) dengan indikator GWP100. Interpretasi dilakukan melalui analisis kontribusi komponen fosil dan biogenik.

Hasil penilaian menunjukkan nilai *Total* sebesar −34.207,241 kg CO_2-eq. Nilai *Total* negatif terutama terbentuk karena pengambilan karbon biogenik pada glulam dan CLT lebih besar daripada emisi positif dalam batas A1–A4. Pelat dan komponen sambungan baja serta pengencang menjadi sumber kontribusi positif terbesar, sedangkan transportasi bukan kontributor utama dibandingkan produksi material. Hasil tersebut merupakan gambaran awal kinerja perubahan iklim pada tahap *cradle-to-site* dan tidak membuktikan bahwa struktur bersifat *carbon negative* sepanjang daur hidup karena tahap konstruksi, penggunaan, dan akhir umur layan tidak dianalisis.

Kata kunci: karbon biogenik, kayu rekayasa, *Life Cycle Assessment*, Pavilion 120, perubahan iklim

ABSTRACT

The construction sector contributes to climate change through raw material supply, material production, and transportation to project sites. This issue is relevant to Pavilion 120 at PIK2 because its superstructure combines meranti glued laminated timber (glulam), red jabon cross-laminated timber (CLT), steel, reinforced concrete, structural connections, and supporting materials with different production processes and supply chains. This study aims to develop a life cycle inventory, quantify climate change impacts, and identify the contributions of materials, production, transportation, and biogenic carbon to the Pavilion 120 superstructure.

The study was conducted as a quantitative case study using a process-based attributional *Life Cycle Assessment* with a *cradle-to-site* boundary covering modules A1–A4 and a reference flow of one Pavilion 120 superstructure. The quantities of glulam, CLT, structural steel profiles, and concrete were obtained through Revit *quantity take-off*, while steel plates, fasteners, reinforcement, welding, resin, and adhesives were quantified using detailed engineering design drawings, project documents, and manual calculations. Transportation activities were calculated for each route based on cargo mass, distance, and transport mode in tonne-kilometres. The project inventory was linked to the BAFU-2026 v1 database and custom processes developed for glulam, CLT, K350 concrete, fasteners, welding, and *chemical anchor resin*. The product system was modelled in openLCA 2.6.2 and characterised using IPCC 2021 (ISO 14067) with the GWP100 indicator. Interpretation was conducted through contribution analysis of fossil and biogenic components.

The assessment resulted in a *Total* climate change impact of −34,207.241 kg CO_2-eq. The negative *Total* mainly resulted from biogenic carbon removals associated with glulam and CLT exceeding the positive emissions within the A1–A4 boundary. Steel plates, connection components, and fasteners were the largest positive contributors, whereas transportation was not a dominant contributor compared with material production. These results represent an initial assessment of climate change performance at the *cradle-to-site* stage and do not demonstrate that the structure is carbon negative over its full life cycle because construction, use, and end-of-life stages were excluded.

Keywords: biogenic carbon, climate change, engineered timber, *Life Cycle Assessment*, Pavilion 120