



ANALISIS PENGARUH SELUBUNG BANGUNAN TERHADAP BEBAN PENDINGINAN DI YOGYAKARTA

Nida Ulya Zulva Rosyidah

17/413566/TK/46006

Diajukan kepada Departemen Teknik Nuklir dan Teknik Fisika Fakultas Teknik
Universitas Gadjah Mada pada tanggal 15 Juli 2024
untuk memenuhi sebagian persyaratan untuk memperoleh derajat
Sarjana Program Studi Teknik Fisika

INTISARI

Peningkatan pertumbuhan penduduk di kota Yogyakarta sejalan dengan peningkatan konsumsi energi listrik, dengan 50% konsumsi listrik digunakan oleh sektor bangunan. Pengondisian udara menyumbang 47%–65% dari total konsumsi energi bangunan. Selubung bangunan memainkan peran penting dalam mengurangi beban pendinginan dengan membatasi panas eksternal yang masuk, sehingga erat kaitannya dengan optimalisasi sistem HVAC (*Heating Ventilating Air-Conditioning Refrigerating*).

Beban pendinginan dapat dihitung menggunakan perangkat lunak IES-VE (*Integrated Environmental Solution Virtual Environment*). Parameter yang digunakan untuk melihat pengaruh selubung bangunan terhadap beban pendinginan berupa geometri, orientasi, dan *Window to Wall Ratio* (WWR). Geometri bangunan uji berupa kubus, prisma segi delapan, prisma segi enam, tabung, dan hemisphere dengan volume 216 m³, 729 m³, dan 1728 m³. Kemudian WWR yang digunakan pada simulasi sebesar 0%, 20%, 50%, dan 75%.

Hasil simulasi didapatkan bentuk geometri paling kompak adalah hemisphere dengan nilai beban pendinginan terendah. Ukuran bangunan memiliki pengaruh signifikan terhadap beban pendinginan, didapatkan rata-rata peningkatan beban pendinginan akibat peningkatan volume selubung bangunan sebesar 50,547%. Kemudian kenaikan nilai WWR sejalan dengan kenaikan beban pendinginan, rata-rata kenaikan sebesar 22,28%. Orientasi bangunan memberikan pengaruh yang relatif kecil terhadap beban pendinginan, di mana pengaruhnya berupa peningkatan atau penurunan beban pendinginan bergantung pada besarnya luas permukaan bangunan yang menghadap arah orientasi barat-timur.

Kata kunci: Beban Pendinginan, Selubung Bangunan, Geometri, Orientasi, WWR

Pembimbing Utama : Dr. Eng. Ir. Mohammad Kholid Ridwan, S.T., M.Sc.,
IPU, GP.





ANALYSIS OF THE EFFECT OF BUILDING ENVELOPE ON COOLING LOAD IN YOGYAKARTA

Nida Ulya Zulva Rosyidah

17/413566/TK/46006

Submitted to the Departement of Nuclear Engineering and Engineering Physics
Faculty of Engineering Universitas Gadjah Mada on *July 15th, 2024*
in partial fulfillment of the requirement for the Degree of
Bachelor of Engineering in Engineering Physics

ABSTRACT

The increase in population growth in the city of Yogyakarta is in line with the increase in electrical energy consumption, with 50% of electricity consumption used by the building. Air conditioning contributes 47%–65% of total building energy consumption. The building envelope plays an important role in reducing the cooling load by limiting the incoming external heat, so it is closely related to the optimization of the HVAC (Heating Ventilating Air-Conditioning Refrigerating) system.

The cooling load can be calculated using IES-VE (Integrated Environmental Solution Virtual Environment). The parameters used to see the effect of the building envelope on the cooling load are geometry, orientation, and *Window to Wall Ratio* (WWR). The geometry of the building model is a cube, octagonal prism, hexagonal prism, tube, and hemisphere with a volume of 216 m³, 729 m³, and 1728 m³ respectively. Then the WWR used in simulation is 0%, 20%, 50%, and 75%.

The simulation results obtained the most compact geometry shape is hemisphere with the lowest cooling load value. The size of the building has a significant effect on the cooling load where the average increase in cooling load due to an increase in the volume of the building envelope is 50,547%. Then the increase in WWR value is in line with the increase in cooling load, an average increase is 22,28%. Building orientation has a relatively small effect on cooling load, where the effect is an increase or decrease in cooling load depending on the amount of building surface area facing the west-east orientation direction.

Keywords: Cooling Load, Building Envelope, Geometry, Orientation, WWR

Supervisor : Dr. Eng. Ir. Mohammad Kholid Ridwan, S.T., M.Sc., IPU, GP.

