

ANALISIS POTENSI PENGGUNAAN BUS LISTRIK DI KOTA YOGYAKARTA BERDASARKAN KARAKTERISTIK ENERGI DAN EMISI CO₂ STUDI KASUS BUS TRANS JOGJA JALUR 2B

Andikha Wira Perkasa

18/424991/TK/46686

Diajukan kepada Departemen Teknik Nuklir dan Teknik Fisika Fakultas Teknik
Universitas Gadjah Mada pada tanggal 16 Agustus 2022
untuk memenuhi sebagian persyaratan untuk memperoleh derajat
Sarjana Program Studi Teknik Fisika

INTISARI

Pengadaan transportasi massal bus Trans Jogja yang ditujukan untuk menekan jumlah kendaraan pribadi belum mampu mengatasi permasalahan konsumsi bahan bakar dan emisi CO₂. Hal ini karena bus yang digunakan adalah tipe ICE dengan bahan bakar fosil serta masih berpotensi menyumbang emisi CO₂. Bus listrik hadir sebagai solusi untuk mengatasi permasalahan ketergantungan bahan bakar fosil sekaligus menjadi transportasi massal yang ramah lingkungan.

Penelitian ini dilakukan untuk mengukur potensi penggunaan bus listrik di Yogyakarta berdasarkan perhitungan konsumsi energi, emisi CO₂, serta akan ditentukan sistem pengisian baterai yang sesuai berdasarkan karakteristik siklus berkendara bus Trans Jogja jalur 2B. Kemudian dibandingkan dengan bus ICE untuk mendapatkan persentase penghematan energi dan reduksi emisi.

Melalui hasil penelitian diperoleh nilai konsumsi energi bus listrik sebesar 19,60 kWh dan nilai emisi CO₂ bus listrik dari sumber pembangkitan menurut proyeksi energi di Indonesia tahun 2025, 2030, 2040, dan 2050 berturut-turut adalah 12,46 kgCO₂; 12,27 kgCO₂; 12,02 kgCO₂; dan 11,87 kgCO₂. Persentase penghematan energi bus listrik adalah sebesar 86,28% dan persentase reduksi emisi CO₂ bus listrik menurut proyeksi energi di Indonesia tahun 2025, 2030, 2040, dan 2050 berturut-turut adalah 67,15%; 67,65%; 68,31%; dan 68,73%. Sistem pengisian baterai bus listrik yang sesuai adalah jenis *fast DC charger* 35 kW dengan lama pengisian 12 menit.

Kata kunci: Bus ICE, Bus Listrik, Energi, Emisi CO₂

Pembimbing Utama : Dr. Ir. Andang Widi Harto, M.T.

Pembimbing Pendamping : Dr. Rachmawan Budiarto, S.T., M.T.



**POTENTIAL USE ANALYSIS OF ELECTRIC BUS IN YOGYAKARTA
BASED ON ENERGY AND CO₂ EMISSION CHARACTERISTICS (CASE
STUDY: TRANS JOGJA BUS LINE 2B)**

Andikha Wira Perkasa

18/424991/TK/46686

Submitted to the Departement of Nuclear Engineering and Engineering Physics
Faculty of Engineering Universitas Gadjah Mada on August 16th, 2022
in partial fulfillment of the requirement for the Degree of
Bachelor of Engineering in Engineering Physics

ABSTRACT

The procurement of mass transportation for Trans Jogja buses aimed at reducing the number of private vehicles has not been able to overcome the problems of fuel consumption and CO₂ emissions. This is because the utilized bus is an ICE type bus with fossil fuels and still has the potential to contribute to CO₂ emissions. The electric bus is as a solution to overcome the problem of dependence on fossil fuels as well as being an environmentally friendly mass transportation.

This study was conducted to measure the potential use of electric buses in Yogyakarta based on calculations of energy consumption, CO₂ emissions, and an appropriate battery charging system will be determined based on the driving cycle characteristics of the Trans Jogja bus line 2B. Then it is compared with the ICE bus to get the percentage of energy savings and emission reductions.

Through the research results, the energy consumption value of electric buses is 19.60 kWh and the CO₂ emission value of electric buses from generation sources according to energy projections in Indonesia in 2025, 2030, 2040, and 2050, respectively, is 12.46 kgCO₂; 12.27 kgCO₂; 12.02 kgCO₂; dan 11.87 kgCO₂. The percentage of electric bus energy saving is 86.28% and the percentage of electric bus CO₂ emission reduction according to energy projections in Indonesia in 2025, 2030, 2040, and 2050 respectively is 67.15%; 67.65%; 68.31%; dan 68.73%. The appropriate electric bus battery charging system is a 35 kW fast DC charger with a charging time of 12 minutes.

Keywords: ICE Bus, Electric Bus, Energy, CO₂ Emission

Supervisor : Dr. Ir. Andang Widi Harto, M.T.

Co-supervisor : Dr. Rachmawan Budiarto, S.T., M.T.

