

## ABSTRAK

Konsumsi energi listrik di Provinsi Aceh terus meningkat seiring pertumbuhan ekonomi dan jumlah penduduk. Prediksi yang akurat sangat penting untuk menunjang perencanaan pasokan listrik yang optimal. Penelitian ini membandingkan dua pendekatan prediksi, yaitu Fuzzy Time Series-Markov Chain (FTSMC) dan Markov Chain Monte Carlo (MCMC), dalam memproyeksikan konsumsi listrik di Aceh untuk periode 2023–2030. Permasalahan utama yang dikaji adalah bagaimana menentukan pola konsumsi listrik berdasarkan data historis (2018–2022) dan memilih metode prediksi yang paling akurat serta relevan untuk perencanaan ke depan. Data diperoleh dari PT PLN (Persero) UIW Aceh dan dianalisis menggunakan perangkat lunak R Studio. FTSMC dan MCMC diterapkan sesuai prosedur standar masing-masing, dengan MCMC memanfaatkan algoritma Metropolis-Hastings dan FTSMC berbasis logika fuzzy serta Markov Chain. Hasil penelitian menunjukkan bahwa FTSMC memberikan nilai Mean Absolute Percentage Error (MAPE) sebesar 3,25%, dengan hasil prediksi yang cenderung stagnan di kisaran 261,1 GWh mulai tahun 2025 hingga 2030. Sementara itu, metode MCMC menghasilkan MAPE sebesar 4,13%, namun mampu menangkap tren pertumbuhan konsumsi listrik secara lebih realistis, yaitu dari 272,1 GWh pada Januari 2023 menjadi 364,8 GWh pada Desember 2030, dengan kenaikan sekitar 34,08% selama delapan tahun. Dengan demikian, meskipun FTSMC lebih unggul dari sisi akurasi historis, MCMC lebih disarankan untuk perencanaan energi listrik jangka panjang karena dapat merefleksikan pola pertumbuhan konsumsi listrik yang terjadi di Aceh.

*Kata kunci: Konsumsi Listrik, Prediksi, Fuzzy Time Series-Markov Chain, Markov Chain Monte Carlo, Metropolis-Hastings.*

## ABSTRACT

Electricity consumption in Aceh Province continues to increase in line with economic growth and population expansion. Accurate forecasting is essential to support optimal electricity supply planning. This study compares two forecasting approaches Fuzzy Time Series-Markov Chain (FTSMC) and Markov Chain Monte Carlo (MCMC) in projecting electricity consumption in Aceh for the period 2023–2030. The main issues addressed are how to identify consumption patterns based on historical data (2018–2022) and determine the most accurate and relevant prediction method for future planning. Data were obtained from PT PLN (Persero) UIW Aceh and analyzed using R Studio software. FTSMC and MCMC were applied according to their respective standard procedures, with MCMC utilizing the Metropolis-Hastings algorithm and FTSMC employing fuzzy logic and Markov Chain principles. The results show that FTSMC yielded a Mean Absolute Percentage Error (MAPE) of 3.25%, with forecast results tending to stagnate at around 261.1 GWh from 2025 to 2030. In contrast, the MCMC method produced a MAPE of 4.13%, yet was able to capture a more realistic growth trend in electricity consumption, from 272.1 GWh in January 2023 to 364.8 GWh in December 2030, representing an increase of approximately 34.08% over eight years. Thus, although FTSMC demonstrates better historical accuracy, MCMC is recommended for long-term electricity planning as it can reflect the actual growth patterns of electricity consumption in Aceh.

*Keywords: Electricity Consumption, Forecasting, Fuzzy Time Series-Markov Chain, Markov Chain Monte Carlo, Metropolis-Hastings.*