ABSTRACT

The government's decision to encourage the use of renewable energy (EBT) makes the problem of unit commitment (UC) more complex. This is because the solar power plant (PLTS) as one of the government-driven EBT plants has the characteristics of high variability and uncertainty. To be able to produce an optimization model that is able to show the characteristics of the variability and uncertainty of the PV curve, this study proposes the development of the Prophet's predictions framework. The proposed development is in the form of hybrid framework which is a combination of dayfilter, ProphetPos, and k-means clustering with the dynamic time warping metric. As a test, two systems are used, those are the IEEE 10 model system to test the sensitivity of system size and IEEE 118 to see the effect of network constraints. The results showed that the development of a hybrid framework was able to produce a stochastic curve that had high variability with an absolute value of daily curve changes (118 $\mathrm{Wh/m^2}$) closer to the real value (100 $\mathrm{Wh/m^2}$) compared to the deterministic curve version (71 $\mathrm{Wh/m^2}$). In testing real-time unit commitment performance based on the day-ahead unit commitment solution, it was found that the stochastic approach (1.321.787.89 $/day) also has a better solution than the deterministic method (1.321.793.88 $/day).

Keywords – renewable energy, Prophet, stochastic unit commitment.

INTISARI

Keputusan pemerintah untuk mendorong penggunaan energi baru terbarukan (EBT) membuat permasalahan *unit commitment* semakin kompleks. Hal ini karena pembangkit listrik tenaga surya (PLTS) sebagai salah satu pembangkit EBT yang didorong pemerintah memiliki karakteristik variabilitas dan ketidakpastian tinggi. Untuk dapat menghasilkan model optimisasi yang mampu menunjukkan karakteristik variabilitas dan ketidakpastian kurva PLTS, penelitian ini mengusulkan *hybrid forecasting framework* yang merupakan penggabungan dari *dayfilter*, *ProphetPos*, dan klasterisasi k-means dengan *metric dynamic time warping*. Sebagai pengujian, digunakan dua sistem yaitu sistem model IEEE 10 untuk menguji sensitivitas ukuran sistem dan IEEE 118 untuk melihat pengaruh adanya kekangan jaringan. Hasil penelitian menunjukkan bahwa pengembangan *hybrid forecasting framework* mampu menghasilkan kurva stokastik yang memiliki variabilitas tinggi dengan nilai absolut perubahan kurva harian (118 $\mathrm{Wh/m^2}$) mendekati nilai sesungguhnya (100 $\mathrm{Wh/m^2}$) dibandingkan dengan versi kurva determinisktik (71 $\mathrm{Wh/m^2}$). Pada pengujian performa *real-time unit commitment* berdasarkan solusi *day-ahead unit commitment*, didapati bahwa pendekatan stokastik (1.321.787,89 $/hari) juga memiliki solusi yang lebih baik dari metode deterministik (1.321.793,88 $/hari).

Kata kunci – energi baru terbarukan, *Prophet*, *stochastic unit commitment*.