INTISARI

Penggunaan pembangkit energi terbarukan berbasis *photovoltaic* (PV) menghadapi tantangan berupa *variability* dan *uncertainty* karena faktor iklim dan cuaca. Untuk mengatasinya, digunakan *Pumped Hydro Storage* (PHS) sebagai *Energy Storage System* (ESS). Akan tetapi, PHS biasanya dibangun di tempat yang tinggi sehingga timbul perbedaan lokasi antara PHS dan pembangkit PV. Adanya perbedaan lokasi menuntut *Independent Power Producer* (IPP) untuk melakukan *power wheeling* guna menghubungkan pembangkit PV, PHS, dan beban *power wheeling*. Biaya yang timbul akibat *Power wheeling* akan dihitung menggunakan metode MW-km hasil implementasi *Kirschen Tracing* dan *postage stamps*.

Tujuan penelitian ini adalah mengetahui pengaruh jarak antar komponen *power wheeling*, mengetahui model biaya *power wheeling* menggunakan metode MW-km dan *postage stamps*, dan perbandingan biaya *power wheeling* yang ditimbulkan oleh penggunaan PV dan PHS. Penelitian ini menggunakan tiga skenario dengan perbedaan jarak pembangkit PV, PHS, dan beban *power wheeling* yang disimulasikan menggunakan Matpower Optimal Scheduling Tools (MOST) dan aliran dayanya dilacak menggunakan algoritma *Kirschen Tracing*. Pada tiap skenario, dihitung biaya *power wheeling* menggunakan metode MW-km dan *postage stamps*. Hasil analisis menunjukkan bahwa jarak antara komponen *power wheeling* tidak berpengaruh pada biaya *power wheeling* metode MW-km dengan *Kirschen Tracing*. Hal ini disebabkan oleh beban *power wheeling* tidak disuplai secara langsung oleh pembangkit *power wheeling*. Sementara itu, hal yang berpengaruh terhadap penghitungan metode MW-km adalah konsentrasi beban dan pembangkit di sekitar pembangkit *power wheeling* yang ditunjukkan oleh kontribusi pembangkit dan penggunaan saluran. Biaya metode MW-km memiliki harga yang lebih adil dibanding *postage stamps* karena mempertimbangkan panjang saluran dan kontribusi pembangkit secara aktual sehingga tidak dimungkinkan subsidi silang.

Kata kunci : *power wheeling*, *Kirschen Tracing*, *pumped hydro storage*, MW-km, *postage stamps*

ABSTRACT

The use of photovoltaic (PV)-based renewable energy plant faces challenges in the form of variability and uncertainty due to climate and weather factors. To solve this, Pumped Hydro Storage (PHS) is used as an Energy Storage System (ESS). However, PHS is usually built at high altitudes, causing different locations between PHS and PV plants. The location difference requires Independent Power Producer (IPP) to perform power wheeling to connect PV plants, PHS, and power wheeling loads. The costs due to power wheeling will be calculated using the MW-km method as a result of the implementation of Kirschen Tracing and postage stamps.

The objectives of this study are to determine the effect of distance between power wheeling components, to determine the power wheeling cost model using the MW-km and postage stamps methods, and to compare the power wheeling costs due to the use of PV and PHS. This study uses three scenarios with different distances of PV plants, PHS, and power wheeling loads that are simulated using Matpower Optimal Scheduling Tools (MOST) and the power flow is traced using Kirschen Tracing algorithm. In each scenario, power wheeling costs were calculated using the MW-km and postage stamps methods. The analysis shows that the distance between power wheeling components has no effect on the power wheeling cost of MW-km method with Kirschen Tracing. This is because the power wheeling load is not supplied directly by the power wheeling generator. Meanwhile, the things that affect the calculation of the MW-km method are the concentration of load and generation around the power wheeling plant as indicated by the contribution of generation and line usage. The MW-km cost method has a fairer price than postage stamps because it considers the actual length of the line and the contribution of the power wheeling plant so that cross-subsidization is not possible.

***Keywords** : power wheeling, Kirschen Tracing, pumped hydro storage, MW-km, postage stamps*