ABSTRAK

OPTIMASI ADOPSI PLTS SKALA RUMAH TANGGA DAYA TERPASANG 1.300 VA DENGAN MENGGUNAKAN METODE *MULTI-OBJECTIVE PARTICLE SWARM OPTIMIZATION*

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Potensi energi terbarukan yang dimiliki Indonesia sangatlah besar, terutama dari energi surya yang mencapai 207,8 GWp. Namun, hingga 2023 pemanfaatannya masih belum optimal akibat berbagai kendala termasuk regulasi yang belum sepenuhnya mendukung. Untuk mengatasi hal ini, penelitian ini berfokus pada optimalisasi *Feed-in Tariff* (FiT), kapasitas pembangkitan, dan tarif rata-rata guna memberikan keuntungan optimal bagi konsumen, prosumer, dan utilitas PT. PLN. Studi ini menggunakan model ekonomi *stakeholder* dengan mengambil kasus pelanggan PT PLN (Persero) UP3 Tanjung Karang kapasitas daya terpasang 1.300 VA. Optimasi dilakukan menggunakan metode *Multi-Objective Particle Swarm Optimization* (MOPSO) dan *Genetic Algorithm* (GA), dengan mempertimbangkan variabel seperti FiT, kapasitas pembangkitan, permintaan energi, tarif rata-rata, dan biaya penyediaan energi. Hasil penelitian menunjukkan bahwa metode *Particle Swarm Optimization* menghasilkan FiT optimal Rp718,12/kWh, dengan penghematan prosumer Rp230.681 dan laba utilitas Rp179.676. Sementara itu, *Genetic Algorithm* menghasilkan FiT Rp564,85/kWh, dengan penghematan prosumer Rp205.172 dan laba utilitas Rp179.692. Berdasarkan hasil optimasi, kedua metode memberikan solusi optimal, namun FiT Rp718,12/kWh direkomendasikan karena menghasilkan periode balik modal lebih cepat serta keuntungan ekonomi lebih besar bagi prosumer dan utilitas. Optimalisasi FiT diharapkan dapat meningkatkan adopsi PLTS atap dan mendukung pencapaian target bauran energi terbarukan di Indonesia.

Kata Kunci: *Feed-in Tariff*, PLTS atap, kebijakan, optimasi, *particle swarm optimization*, *algoritma genetika*.

ABSTRACT

OPTIMIZATION OF 1.300 VA HOUSEHOLD-SCALE SOLAR POWER PLANT ADOPTION USING MULTI-OBJECTIVE PARTICLE SWARM OPTIMIZATION METHODS

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Indonesia has enormous renewable energy potential, especially from solar energy which reaches 207.8 GWp. However, until 2023 its utilization is still not optimal due to various obstacles including regulations that are not fully supportive. To overcome this, this study focuses on optimizing the Feed-in Tariff (FiT), generation capacity, and average tariff to provide optimal benefits for consumers, prosumers, and utility PT PLN. This study uses a stakeholder economic model by taking the case of PT PLN (Persero) UP3 Tanjung Karang customers with an installed power capacity of 1,300 VA. Optimization is carried out using the Multi-Objective Particle Swarm Optimization (MOPSO) and Genetic Algorithm (GA) methods, taking into account variables such as FiT, generation capacity, energy demand, average tariffs, and energy supply costs. The results showed that the Particle Swarm Optimization method resulted in an optimal FiT of Rp718.12/kWh, with prosumer savings of Rp230,681 and utility profit of Rp179,676. Meanwhile, Genetic Algorithm produced a FiT of Rp564.85/kWh, with prosumer savings of Rp205,172 and utility profit of Rp179,692. Based on the optimization results, both methods provide optimal solutions, but the FiT of Rp718.12/kWh is recommended because it results in a faster payback period and greater economic benefits for prosumers and utilities. FiT optimization is expected to increase rooftop solar PV adoption and support the achievement of Indonesia's renewable energy mix target.

Key words: Feed-in Tariff, rooftop solar PV, policy, optimization, particle swarm optimization, genetic algorithm.