FINANCIAL AND RISK VALUATION OF SOLAR POWER PLANTS FOR JAKARTA METRO PUBLIC TRANSPORTATION IN INDONESIA: A PVSYST AND RETSCREEN ANALYSIS

FINAL PROJECT

In partial fulfilment of the requirements for the master's degree from Institut Teknologi Bandung

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Abstract

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Abstract: The study focuses on the feasibility and financial viability of integrating solar photovoltaic (PV) technology into Jakarta Metro's public transportation system. Utilizing sophisticated modeling tools like PVsyst and RETScreen, the research assesses various scenarios to determine the optimal approach for sustainable energy integration. Four scenarios were evaluated: Base Case, Lifetime Optimization, Carbon Credits Adjustment, and a Proposed Scenario combining extended lifespan with carbon pricing. The research highlights Scenario 4 as the most advantageous, offering the highest financial returns and environmental benefits. This scenario extends the project's lifespan to 30 years and incorporates a $50 per ton CO2 carbon price, resulting in significant revenue from carbon credits. Financial metrics such as Net Present Value (NPV), Internal Rate of Return (IRR), and Benefit-Cost Ratio (BCR) are highest in Scenario 4, making it the most attractive option for investors, developers, and government stakeholders. The integration of solar PV technology in Jakarta Metro is aligned with national and international sustainability goals, reducing greenhouse gas emissions and dependency on fossil fuels while enhancing energy security. The study concludes with recommendations for the strategic adoption of solar energy in urban transit systems, emphasizing the potential for significant environmental and economic benefits.

Keywords: PV Project Valuation, Metro Transportation, Renewable Energy, Energy Transition, Feasibility Study, RETScreen

Abstrak

Penilaian Finansial dan Risiko Pembangkit Listrik Tenaga Surya untuk Transportasi Umum Metro Jakarta di Indonesia: Analisa PVsyst dan RETScreen

Oleh

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Kajian ini berfokus pada kelayakan dan kelayakan finansial dari integrasi teknologi fotovoltaik surya (PV) ke dalam sistem transportasi umum Metro Jakarta. Dengan memanfaatkan alat pemodelan canggih seperti PVsyst dan RETScreen, penelitian ini menilai berbagai skenario untuk menentukan pendekatan optimal untuk integrasi energi berkelanjutan. Empat skenario yang dievaluasi: Kasus Dasar, Optimasi Seumur Hidup, Penyesuaian Kredit Karbon, dan Skenario Usulan yang menggabungkan perpanjangan umur dengan penetapan harga karbon. Penelitian ini menyoroti Skenario 4 sebagai skenario yang paling menguntungkan, menawarkan keuntungan finansial dan manfaat lingkungan tertinggi. Skenario ini memperpanjang umur proyek hingga 30 tahun dan mencakup harga karbon CO2 sebesar $50 per ton, sehingga menghasilkan pendapatan yang signifikan dari kredit karbon. Metrik keuangan seperti Net Present Value (NPV), Internal Rate of Return (IRR), dan Benefit-Cost Ratio (BCR) berada pada posisi tertinggi pada Skenario 4, menjadikannya pilihan paling menarik bagi investor, pengembang, dan pemangku kepentingan pemerintah. Integrasi teknologi PV surya di Metro Jakarta selaras dengan tujuan keberlanjutan nasional dan internasional, mengurangi emisi gas rumah kaca dan ketergantungan pada bahan bakar fosil sekaligus meningkatkan ketahanan energi. Studi ini diakhiri dengan rekomendasi untuk penerapan strategis energi surya dalam sistem transportasi perkotaan, dengan menekankan potensi manfaat lingkungan dan ekonomi yang signifikan.

Kata Kunci: Penilaian Proyek PV, Transportasi Metro, Energi Terbarukan, Transisi Energi, Studi Kelayakan, RETScreen

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FINAL PROJECT GUIDANCE

Alhamdulillah bini'matihi tatimmush sholihaat

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"An investment in knowledge pays the best interest."
Benjamin Franklin

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