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## INTISARI

Prarancangan pabrik ini diperuntukkan untuk mengetahui kelayakan dari pendirian pabrik *syngas* dari batubara dengan metode *wet gasification* untuk pembangkit listrik dengan kapasitas produksi 1000 MW. *Syngas* merupakan *intermediate product* sebagai salah satu produk turunan batubara hasil dari proses gasifikasi dan dapat digunakan sebagai alternatif bahan bakar pembangkit listrik.

Pabrik *syngas* dari batubara ini dirancang untuk beroperasi selama 330 hari/tahun dan 24 jam/hari. Pabrik ini membutuhkan bahan bakar berupa batubara jenis sub bituminus sebanyak 164142 kg/jam yang akan digasifikasi dan diproses sehingga terbentuk *syngas* sebanyak 453898 kg/jam. Selain itu, dibutuhkan air sebanyak 252524 kg/jam dan udara sebanyak 1618686 kg/jam. *Syngas* yang diproduksi terdiri dari karbon monoksida (CO), karbon dioksida (CO<sub>2</sub>), air (H<sub>2</sub>O), hidrogen (H<sub>2</sub>), nitrogen (N<sub>2</sub>), metana (CH<sub>4</sub>), dan H<sub>2</sub>S. Terdapat tiga tahap pada proses produksi *syngas*, yakni tahap persiapan bahan baku, tahap gasifikasi batubara pada gasifier, dan tahap pemurnian *syngas*. Gasifikasi yang terjadi pada reaktor *entrained bed gasifier* dijalankan pada suhu masuk 1500 °C dan tekanan 40 atm.

Pabrik ini dirancang untuk didirikan di Kecamatan Gresik, Kabupaten Gresik, Provinsi Jawa Timur dengan mempekerjakan 269 karyawan. Selain bahan baku utama, kebutuhan proses produksi pabrik ini membutuhkan energi listrik sebanyak 61,97 MW, air *make-up* untuk utilitas sebanyak 1203741 kg/jam, dan udara instrumen sebanyak 101 m<sup>3</sup>/jam.

Pendirian pabrik ini membutuhkan *fixed capital* sebesar \$227,034,842 + Rp445.625.305.689,22 dan *working capital* sebesar \$81,023,585 + Rp6.098.314.321,22. Berdasarkan prosesnya, pabrik ini digolongkan sebagai pabrik *high risk*. Selanjutnya, analisis kelayakan menunjukkan bahwa nilai *Return on Investment (ROI) before tax* 45%, *Return on Investment (ROI) after tax* 23%, *Payout Time (POT) before tax* 1,8 tahun, *Payout Time (POT) before tax* 3,06 tahun, *Breakeven Point (BEP)* 45,71%, *Shutdown Point (SDP)* 27,81%, dan *Discounted Cash Flow Rate of Return (DCFRR)* 41,46%. Berdasarkan nilai-nilai tersebut, dapat disimpulkan bahwa secara ekonomi pendirian pabrik ini layak untuk dikaji lebih lanjut.

**Kata kunci:** *syngas*, PLTGU, batubara, gasifier, gasifikasi



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## ABSTRACT

This preliminary plant design is intended to study the feasibility of a syngas plant from coal using the wet gasification method for a power plant with a production capacity of 1000 MW. Syngas is an intermediate product as a coal derivative product resulting from the gasification process and can be used as an alternative fuel for power plants.

This coal syngas plant is designed to continuously operates for 330 days/year and 24 hours/day. To meet the electricity production capacity of 1000 MW, the production process requires 164142 kg/hour of coal, which will be gasified and processed to form 453898 kg/hour syngas. In addition, the production process requires 252524 kg/hour of water, and 1618686 kg/hour of air as other main raw materials. The production process uses low-quality sub-bituminous coal. Syngas produced consist of carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), water (H<sub>2</sub>O), hydrogen (H<sub>2</sub>), nitrogen (N<sub>2</sub>), methane (CH<sub>4</sub>), and H<sub>2</sub>S. The syngas production process has three stages: the raw material pretreatment stage, the coal gasification in the gasifier stage, and the syngas purification stage. The gasification that occurs in the entrained bed gasifier reactor is carried out at an inlet temperature of 1500 °C and a pressure of 40 atm.

This factory is designed to be established in Gresik District, Gresik Regency, East Java Province, with 269 employees. In addition to the main raw materials, the production process of this factory requires 61.97 MW of electrical energy, 1203741 kg/hour of make-up water for utilities, and 101 m<sup>3</sup>/hour of instrument air.

A fixed capital of \$227,034,842 + Rp445.625.305.689,22 and a working capital of \$81,023,585 + Rp6.098.314.321,22 is required to run the production. Based on the process, this plant can be classified as a high-risk factory. Furthermore, the feasibility analysis shows that the Return on Investment (ROI) before tax is 45%, Return on Investment (ROI) after tax is 23%, Payout Time (POT) before tax is 1.8 years, Payout Time (POT) before tax is 3.06 years old, Breakeven Point (BEP) 45.71%, Shutdown Point (SDP) 27.81%, and Discounted Cash Flow Rate of Return (DCFRR) 41.46%. Based on these values, it can be concluded that the preliminary design of this plant is economically deserving of further study.

**Keywords:** syngas, PLTGU, coal, gasifier, gasification