

INTISARI

Syngas didefinisikan sebagai gas dimana H_2 dan CO sebagai komponen utama bahan bakar yang dihasilkan dari gasifikasi material yang mengandung karbon. Syngas dapat dimanfaatkan dalam proses pembuatan methanol, pembuatan ammonia, dan menghasilkan energi listrik.

Pabrik syngas dari batu bara, karbon dioksida, dan *steam* ini dirancang dengan kapasitas 500.000 ton/tahun dan beroperasi secara kontinyu selama 330 hari/tahun dan 24 jam/hari. Proses produksi membutuhkan 409.146,3096 ton/tahun Batu bara *bituminous*. Proses yang dilakukan pada pabrik ini adalah gasifikasi Batu bara yang menghasilkan *syngas* yang akan dijual sebagai bahan baku proses *Fischer-Tropsch*. Pada gasifikasi, reaksi dijalankan pada reaktor *entrained bed gasifier* dengan suhu masuk $1.250^{\circ}C$ dan tekanan 30 atm. Cyclone digunakan untuk memisahkan fasa padatan dengan fasa gas. Lalu gas CO dan *steam* dikonversi menjadi gas CO_2 dan H_2 pada *High Temperature Shift Converter* (HTSC), untuk selanjutnya CO_2 diserap didalam absorber dengan solven *Methyl Diethanolamine* (MDEA). Syngas murni dipanaskan menggunakan heat exchanger kemudian digunakan untuk memutar turbin gas. Syngas disimpan di dalam *floating roof tank* pada suhu $20,2743^{\circ}C$ dan tekanan 3 atm.

Pabrik direncanakan didirikan di Kecamatan Paiton, Kabupaten Probolinggo, Provinsi Jawa Timur dengan luas 13 hektar dan 195 orang karyawan. Kebutuhan listrik pabrik syngas sebanyak 38,9328 MW. Sedangkan kebutuhan air *make-up* untuk utilitas sebanyak 323,8545 ton/jam, udara instrument sebanyak $688 m^3$ /jam, dan bahan bakar sebanyak 41,5468 ton/jam Batu bara dan 2,0660 Ton/jam CH_4 .

Modal tetap pabrik syngas sebesar \$221.517.907,02 dan modal kerja sebesar \$40.479.674,53. Pabrik syngas dari Batu bara dan karbon dioksida tergolong *high risk* dengan nilai ROI *before tax* 28,17% ROI *after tax* 14,09%, POT *before tax* 2,62 tahun, POT *after tax* 4,15 tahun, BEP 52,88%, SDP 27,86%, dan DCFRR 30,45%. Berdasarkan data diatas dapat disimpulkan bahwa pabrik syngas menarik secara ekonomi.

Kata kunci: syngas, batu bara, gasifikasi, karbon dioksida, *steam*.

ABSTRACT

Syngas is defined as a gas in which H_2 and CO are the main components of fuel produced from the gasification of carbon-containing materials. Syngas can be used in the process of making methanol, making ammonia, and producing electrical energy.

The syngas plant from coal, carbon dioxide, and steam is designed with a capacity of 500,000 tons/year and operates continuously for 330 days/year and 24 hours/day. The production process requires 409.146,3096 tons/year of bituminous coal. The process carried out at this plant is coal gasification which produces syngas that will be sold as raw material for the Fischer–Tropsch process. In gasification, the reaction is carried out in an entrained bed gasifier reactor with an inlet temperature of $1250^{\circ}C$ and a pressure of 30 atm. Cyclones are used to separate the solid phase from the gas phase. Then the CO gas and steam are converted into CO_2 and H_2 gas at the High-Temperature Shift Converter (HTSC), then CO_2 is absorbed in the absorber with Methyl Diethanolamine (MDEA) solvent. Pure syngas is heated using a heat exchanger and then used to turn a gas turbine. Syngas is stored in a floating roof tank at a temperature of $26.2635^{\circ}C$ and a pressure of 3 atm.

The factory is planned to be established in Paiton District, Probolinggo Regency, East Java Province with an area of 13 hectares and 195 employees. The syngas plant's electricity needs are 38.9328 MW. Meanwhile, the need for make-up water for utilities is 323.8545 tons/hour, instrument air is 688 m³/hour, and fuel is 41.5468 tons/hour Coal and 2,0660 tons/hour CH_4 .

The fixed capital for the syngas plant was \$221,517,907.02 and the working capital was \$40,479,674.53. Syngas factory from coal and carbon dioxide is classified as high risk with ROI before tax value 28.17% ROI after tax 14.09%, POT before tax 2.62 years, POT after tax 4.15 years, BEP 52.88%, SDP 27.86%, and DCFRR 30.45%. Based on the data above, it can be concluded that the syngas plant is economically attractive.

Keywords: *syngas, coal, gasification, carbon dioxide, steam*