

INTISARI

Synthetic gas atau *syngas* merupakan campuran gas yang sebagian besar komponennya tersusun dari CO dan H₂. *Syngas* umumnya dimanfaatkan sebagai bahan baku pada industri kimia, seperti dalam proses pembuatan amonia, metana, dan urea. Selain itu, *syngas* dapat dimanfaatkan sebagai bahan bakar untuk pembangkit listrik.

Syngas dapat diproduksi melalui proses gasifikasi batu bara. Pada pabrik ini digunakan batu bara *bituminous* dengan metode *wet gasification* yang dilakukan dengan reaktor *entrained flow gasifier* pada tekanan 40 atm dan suhu 1500°C. Proses produksi *syngas* untuk pembangkit listrik terbagi menjadi enam tahapan unit, yaitu unit persiapan bahan baku, unit persiapan oksigen, unit gasifikasi, unit *particulate removal* dan hidrolisis COS, unit desulfurisasi, dan unit pembangkit. Pabrik ini dirancang dengan kapasitas produksi listrik sebesar 250 MW yang beroperasi selama 330 hari/tahun. Kebutuhan bahan baku untuk proses produksi yaitu batu bara sebanyak 50.587,40 kg/jam, air sebanyak 11.111,15 kg/jam, dan O₂ + N₂ sebanyak 39.926,38 kg/jam. *Syngas* yang dihasilkan sebanyak kg/jam yang terdiri dari campuran gas CO, H₂, CO₂, H₂O, serta sedikit H₂S. Selain itu, terdapat produk samping berupa *slag* sebanyak 6.927 kg/jam.

Pendirian pabrik direncanakan di *Kaltim Industrial Estate* (KIE), Bontang, Kalimantan Timur dengan luas area 9 Ha dan 274 karyawan. Kebutuhan material utilitas untuk pabrik ini meliputi *intake* air laut sebanyak 2.053.773,21 kg/jam, *steam* sebanyak kg/jam, penyedia udara sebesar 624.237,80 kg/jam, dan listrik sebesar 9.853,33 kW.

Pabrik ini tergolong *high risk chemical industri* yang membutuhkan modal tetap sebesar \$139.021.726,03 dan modal kerja sebesar \$50.737.285,68. Pada kapasitas produksi 100%, diperoleh ROI *before tax* sebesar 44,07%, ROI *after tax* sebesar 34,20%, POT *after tax* sebesar 2,31 tahun, dan POT *before tax* sebesar 1,88 tahun. Selain itu, diperoleh nilai BEP sebesar 47,43%, SDP sebesar 30,20%, dan DCFRR sebesar 35,03%. Berdasarkan analisis ekonomi tersebut, pabrik ini menarik dari segi ekonomi dan layak dikaji lebih lanjut.

Kata kunci: Batu bara, *bituminous*, *wet gasification*, *syngas*, listrik

ABSTRACT

Synthetic gas or syngas is a gas mixture whose components are mostly composed of CO and H₂. Syngas is commonly used as a raw material in the chemical industry, such as in the manufacture of ammonia, methane, and urea. In addition, syngas can be utilized as fuel for power generation.

Syngas can be produced through a coal gasification process. In this plant, bituminous coal is used with the wet gasification method carried out in an entrained flow gasifier reactor at a pressure of 40 atm and a temperature of 1500 °C. The syngas production process for power generation is divided into six unit stages, namely the raw material preparation unit, oxygen preparation unit, gasification unit, particulate removal unit and COS hydrolysis, desulfurization unit, and generating unit. The plant is designed with an electricity production capacity of 250 MW operating for 330 days/year. The raw material requirements for the production process are 50,587.40 kg/hour of coal, 11,111.15 kg/hour of water, and 39,926.38 kg/hour of O₂ + N₂. Syngas produced as much as kg / hour consists of a mixture of CO, H₂, CO₂, H₂O, and a little H₂S gas. In addition, there are side products in the form of slag as much as 6,927 kg/hour.

The plant is planned in Kaltim Industrial Estate (KIE), Bontang, East Kalimantan with an area of 9 Ha and 274 employees. The material utility requirements for this plant include seawater intake of 2,053,773.21 kg/hr, steam of kg/hr, air supply of 624,237.80 kg/hr, and electricity of 9,853.33 kW.

This plant is classified as a high risk chemical industry that requires fixed capital of \$139,021,726.03 and working capital of \$50,737,285.68. At 100% production capacity, the ROI before tax is 44.07%, ROI after tax is 34.20%, POT after tax is 2.31 years, and POT before tax is 1.88 years. In addition, the BEP value of 47.43%, SDP of 30.20%, and DCFRR of 35.03% were obtained. Based on the economic analysis, the plant is economically attractive and worthy of further study.

Keywords: Coal, bituminous, wet gasification, syngas, electricity