

Analisis teknologi-ekonomi energi panas bumi entalpi-rendah pada sistem combined cooling, heating, and power generation CCHP di bangunan hotel = Techno economics analysis of low enthalpy geothermal on a combined cooling heating and power generation CCHP system in hotel building

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Abstrak

Indonesia memiliki potensi geotermal yang sangat besar, meliputi entalpi-tinggi dan entalpi-rendah. Geotermal entalpi-rendah dapat dimanfaatkan sebagai sumber energi untuk CCHP, merupakan alternatif untuk memenuhi kebutuhan energi gedung komersial yaitu pendingin, listrik, dan pemanas. CCHP dapat diaplikasikan di bangunan hotel dalam rangka konservasi energy menjadi green building. Pada penelitian ini diasumsikan bangunan hotel bintang lima akan didirikan di Kota Baru Meikarta membutuhkan energi sebesar 7941,81 kW yang terdiri dari pendingin, pemanas, dan listrik. Analisis kinerja teknis sistem CCHP menggunakan piranti lunak Cycle Tempo dilakukan dengan dua skenario utilisasi fluida panas bumi. Hasil simulasi memperlihatkan bahwa dengan skenario fluida geotermal di bagi 15 menuju siklus pembangkit dan waste heat siklus tersebut digabungkan dengan 85 fluida geotermal menuju siklus pendingin dan sistem pemanas,. efisiensi sistem CCHP 36,34 dan penurunan emisi CO₂ hingga 1,4459 tonCO_{2eq}/tahun dapat dicapai. Simulasi borehole dengan kedalaman 400 m dan diameter 8 inci menggunakan piranti lunak COMSOL untuk mendapatkan profil temperatur dan kecepatan fluidageotermal. Analisis finansial dengan metode cash flow menggunakan Ms. Excel. Skema bisnis terbaik adalah Build, Own, Operate BOO dengan insentif fiskal, soft loan, dan grant sehingga biaya produksi energi adalah Rp1039/kWth, Rp1388/kWeh, dan Rp163.550/MMBtu secara berurutan untuk pendingin, listrik, dan pemanas.

.....As Indonesia located on the ring of fire, it has a massive geothermal reserve for both high enthalpy and low enthalpy. Low enthalpy geothermal that is utilized as CCHP's source is the solution to fulfil energy demand in three outputs, which are cooling, heating, and power. CCHP based on low enthalpy geothermal application in hotel building is a form of energy conservation, which is green building. A five star hotel was assumed to be built in Meikarta City with total energy demand of 7941,81 kW that consist of cooling, heating, and electricity. Technical analysis for CCHP system uses Cycle Tempo program to simulate two scenarios.

The chosen scenario was scenario 2, which fresh geothermal was divided by 15 to power generation and the waste heat was merged with the other 85 of fresh geothermal to enter refrigeration and heating systems. The CCHP system efficiency was 36,34. The CO₂ emission was decreased by 1,4459 tonCO_{2eq} year from conventional source. Technical analysis for borehole uses COMSOL program, which depth of borehole is function of temperature and diameter is function of mass flow rate. The surface conditions of geothermal fluid were 149,5 °C and 1,2273 m/s. Economics analysis uses Ms. Excel with cash flow method. The best business scheme is Build, Own, Operate with modifications of fiscal incentives, soft loan, and grant. Therefore, the production prices are Rp1039/kWth, Rp1388/kWeh, and Rp163.550/MMBtu for cooling, electricity, and heating respectively.