

This paper presents the engineering and economic evaluations and analysis for electric power generation using refinery residues as fuel sources. It presents the methodology of the study; bases of design and economic evaluation; economic analysis and results. The study focused on the technical aspects and the economic performance of various conceptual residue-to-power options based on residue-fired, boiler-based, power plants technology. Three technically feasible power plant options were conceptually designed to generate a net 500 MW of electric power using liquid refinery residue (asphalt) and solid residue (petcoke). The conceptual power plant is assumed to be adjacent to the Saudi Aramco's refinery in Rabigh, Saudi Arabia. The residue power options were configured to generate electric power for refinery use and for export. A discounted cash flow approach was used to evaluate the cost of generation for each power plant option. The economics of the electric power generating options were analyzed and the levelized cost of electricity was calculated for each option. The economic performance of the three options were compared to a conventional power plant firing natural gas. The results of the levelized cost of generation for all the power options are presented for both high and low fuel price conditions. The conventional, natural gas-fired simple cycle gas turbine plant (GT-NG) serves as a reference against which the gasification plants may be compared. The results indicate that the levelized cost of generation is very sensitive to the price of fuel used. At the low end of the feedstock price scale, the conventional natural gas-fired power plant is more attractive than all the residue-based power plants. That is, where natural gas is available and cheap, residue-based plants are not economically attractive. At the high end of the natural gas price scale, the results show that all of the residue-based plants are economically more attractive than the conventional power plant if petroleum coke (petcoke) and asphalt can be supplied to these plants at zero cost.