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Energy efficiency assessment of fixed asset investment projects – A case study of a Shenzhen combined-cycle power plant

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ABSTRACT

The assessment of fixed asset investment projects of energy conservation is based on a scientific and systematic approach to analyze the energy production, consumption and management and helps to analyze whether the use of energy is in line with the national and local industrial policies and whether the project design meets China's energy saving design outlines and industry standards. The level of energy consumption is compared to the domestic and international advanced levels regarding the project energy use and process analysis, in all aspects of energy production and energy consumption, taking technically feasible, economically reasonable and environmentally and socially responsible measures and effective and rational use of energy, to reduce consumption and losses and to stop waste, while investigating if the project has a certain advanced and rational use of energy. This study provides a full consideration of whether there is a scientific and rational use of energy to avoid low-level repetition construction, to avoid blind expansion trends, and to promote the upgrading of industrial structure. This paper takes as an example a gas turbine power plant in Shenzhen as an assessment case study of the potential energy savings. The project is expected to have an annual power supply of 37.89×10^8 kW h and an annual heat supply of 5.43×10^4 GJ. The consumption of power generation in tons of coal equivalent units is expected to reach 208 g per kW h. The comprehensive annual average thermal efficiency is 77.16%, and the average heat-to-power ratio is 40.65%. These technical indicators are thought to be one of the best compared to similar level projects in the country.

Contents

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1. Introduction

1.1. Energy assessment significance

Energy audits, performed through field investigation, data verification and necessary tests, analysis of energy utilization and confirmation of its energy utilization levels, are very crucial to find the problems and defects, tap the business potential for energy savings, implement energy-saving measures and propose practical recommendations to help energy companies improve the energy management level while promoting economic and environmental sustainability [1].

The energy conservation assessment in fixed asset investment projects is performed as an assessment of the energy use status on the investment project. The energy conservation assessment (ECA) in a fixed asset investment is similar to an environmental impact assessment in different departments to improve the energy efficiency of new and existing projects. Although the ECA system has been established for only a relatively short period of time, it has obviously made remarkable achievements in improving China's energy efficiency and has played an important role in reducing greenhouse gas emissions [2]. With implementation of the ECA system, China will be able to obtain the benefits of energy efficiency, help address climate change and make significant contributions [3].

The overall results of the energy input–output analysis showed that the increase in domestic investment in China has brought a significant national energy consumption growth. China's construction industry and equipment manufacturing combined accounted for more than 90% of its investment-led domestic energy consumption; the results reflect the fact that China's rapid urbanization and industrialization required the expenditure of huge amounts of energy. In 2007, the construction industry consumed 793.74 million tons of coal equivalent, which was about 29.6% of the total China's national energy consumption [4]. Given this fact, we can conclude that the short life of buildings and infrastructure [5] and variety of China's many industrial sectors has led to inefficient use of capital, energy and consumption of other resources corresponding to the related investment activities. From our perspective, based on the study implemented to increase the energy saving potential of the mining Chinese economy, China's policy makers should increase their national energy efficiency requirements [6].

In China's current energy pricing system, the advantages of gas-fired power plants, which have low investment costs and high efficiency, have not been able to offset the low price of coal. Gas-fired power plants, both in the downstream of the liquefied natural gas (LNG) industry and in the upstream of the power industry, are faced with a problem: policy guidelines are required to solve the problems they face as well as to ensure future development of gas-fired power projects [7].

Gas-fired power generation competitiveness relative to coal powered plants depends on three factors: the price of natural gas relative to coal, the investment costs of a natural gas power plant compared to a coal-fired power plant and the price of carbon. Given reasonable fuel prices and investment cost reduction, implementing a series of economic reform policy interventions is in line with China's broader goals of energy policy. In contrast with the traditional view, applications of natural gas peaking power systems in China are already cost competitive [8].

Meet the future electricity demand and current environmental regulations, is considered to be the main driving force to upgrade the existing coal-fired power plants. In this context, the integration of the gas turbine is an effective technology to improve power plant capacity and operational flexibility [9].

India has a mix of energy resources, including fossil fuels (coal, lignite, oil and gas) and renewable energy (wind, solar, small hydro, biomass, etc.). Approximately three-fifths of the country's power generation capacity depends on fossil fuels, mainly based on the domestic coal reserves. In the past decade, due to the lower capital requirements, shorter construction period and higher efficiency, the natural gas generation capacity is also growing very rapidly in the overall power generation capacity [10].