

## Using Low-Calorie Gas to Generate Heat and Electricity

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**Abstract :** The low-calorie of gases include biogas, coal gas, coke oven gas, associated petroleum gas, gases sewage, etc. These gases are usually released into the atmosphere or burned on flares, causing substantial damage to the environment. However, with the right approach, low-calorie gas fuel can become a valuable source of energy. Specified determines the relevance of areas related to the development of low-calorific gas utilization technologies. As an example, in the work considered one of way of utilization of coalmine gas, because Ukraine ranks fourth in the world in terms of coal mine gas emission (4.7% of total global emissions, or 1.2 billion m<sup>3</sup> per year). Experts estimate that coal mine gas is actively released in the 70-80 percent of existing mines in Ukraine. The main component of coal mine gas is methane (25-60%) Methane in 21 times has a greater impact on the greenhouse effect than carbon dioxide disposal problem has become increasingly important in the context of the increasing need to address the problems of climate, ecology and environmental protection. So marked causes negative effect of both local and global nature. The efforts of the United Nations and the World Bank led to the adoption of the program 'Zero Routine Flaring by 2030' dedicated to the cessation of these gases burn in flares and disposing them with the ability to generate heat and electricity. This study proposes to use coal gas as a fuel for gas engines to generate heat and electricity. Analyzed the physical-chemical properties of low-calorie gas fuels were allowed to choose a suitable engine, as well as estimate the influence of the composition of the fuel at its techno-economic indicators. Most suitable for low-calorie gas is engine with pre-combustion chamber jet ignition. In Ukraine is accumulated extensive experience in exploitation and production of gas engines with capacity of 1100 kW type GD100 (10GDN 207/2 \* 254) fueled by natural gas. By using system pre-combustion chamber jet ignition and quality control in the engines type GD100 introduces the concept of burning depleted burn fuel mixtures, which in turn leads to decrease in the concentration of harmful substances of exhaust gases. The main problems of coal mine gas as a fuel for ICE is low calorific value, the presence of components that adversely affect combustion processes and terms of operation of the ICE, the instability of the composition, weak ignition. In some cases, these problems can be solved by adaptation engine design using coal mine gas as fuel (changing compression ratio, fuel injection quantity increases, change ignition time, increase energy plugs, etc.). It is shown that the use of coal mine gas engines with prechamber has not led to significant changes in the indicator parameters ( $\eta_i = 0.43 - 0.45$ ). However, this significantly increases the volumetric fuel consumption, which requires increased fuel injection quantity to ensure constant nominal engine power. Thus, the utilization of low-calorie gas fuels in stationary gas engine type-based GD100 will significantly reduce emissions of harmful substances into the atmosphere when the generate cheap electricity and heat.

**Keywords :** gas engine, low-calorie gas, methane, pre-combustion chamber, utilization

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