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THE ROLE OF RK-3 IEM IN THE FARGONA VALLEY POWER GRID AND FEATURES AND ADVANTAGES OF THE INTEGRATED GAS TURBINE

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Abstract

In this article, the problems of the electrical system of industrial enterprises, several mode parameters in addition to the scheme parameters given in the determination of the electrical network mode, including the active power in the electrical system, the active and reactive loads of consumers, and the distribution parameters between the node voltage for all variable modes complex optimization and evaluation criteria of active-reactive power from mode parameters were studied and researched.

Keywords; Active and reactive power, transformers, design process, complex optimization, natural method, Synchronous compensator, Synchronous drives.

Introduction

Delivery of the necessary devices is planned by 2 foreign and domestic manufacturing enterprises, including the delivery of devices for the RK-3 IES of the Tashkent electric company from Kawasaki, Eurasia, and Uzbekistan (Tash). The main part of construction was carried out by Uzbekhydro canal.

Construction of 7 MW high-performance congerational gas turbines is planned at Fergana IEM JSC. The main purpose of the project is to strengthen cooperation between the states of Uzbekistan and Japan, to introduce highly efficient technologies in the energy sector, to overcome shortage of heat energy in the Fergana valley in the field of electric power, especially industrial enterprises located in the city of Fergana.

This heating technology was brought in in 2019 and launched in December. As a result, about 20 thousand apartments out of 77 multi-storey buildings in the city of Fergana are provided with heat.

Today, it is clear that without electricity, there can be no prosperous life or a developed economy. Therefore, our country is now undergoing enormous changes in order to quickly solve the problems that have accumulated in the field of electricity supply for many years, to please the people, and to accelerate the development of our economy.

Despite the recent transition to environmentally friendly and clean sources of electricity production, thermal power plants bear the "heaviest burden" of the industry in many countries of the world, including our country. Today, they account for more than 85% of the total electricity generated in Uzbekistan. The Decree of the President of Uzbekistan dated February 21, 2017 "On measures for the introduction of technology of high-efficiency cogeneration gas pipe installations in the territory of the Fergana IEM and in the Fergana city boiler RK-3" plays an important role in the gradual introduction of modern and efficient technologies of electricity generation, rational use of fuel and energy resources, increasing the industrial potential of the region and creating additional jobs plays.

This project is significant because it is aimed at satisfying the demand for electricity in the Fergana Valley, especially in the industrial enterprises located in the city of Fergana.

To this end, in December 2019, within the framework of the project, a 7 MW gas turbine with a capacity was successfully put into operation in Fergana. Today, the electricity produced here is supplied to the national electricity system and to **77 multi-storey houses with 3,850 apartments** located in the Abdulla Kadiri district of Fergana .

At this time, an additional **58,400.0 thousand kWh of** electricity is transmitted to the grid per year. Consumers **enjoy 63400,0 Gcal of thermal** energy. These works led to a decrease in conditional fuel consumption for the production of electricity and heat.

Fuel supply, constituent composition of natural gas.

The main and backup fuel for the gas turbines installed at the Fergana IES and RK-3 is natural gas from the gas distribution system. The gas composition is presented in the table below.

The average caloric content of natural gas **is 8090 kcal / nm3**, under normal conditions the gas density is **0.711 kg / mz.**

Fer TES inlet gas supply pipeline guaranteed by the gas supplier stable gas pressure **0.3 MPa (izb.)**

At the entrance to the Fer TES, the guaranteed stable gas pressure by the gas supplier in the pipeline guaranteed by the gas supplier is **0.3 MPa (g)**

The exhaust gases from the gas turbine are fed into a high-pressure steam generation boiler. After the heat boiler **120-180 °** C temperature combustion products are directed to the metal smoke pipe **(h=15m, og'iz d=1.6m-zararli** based on the propagation of substances and noise).

GTU works as follows. In the GTU compressor, compressed air enters the combustion chamber continuously, where it ensures the combustion of gaseous or liquid fuel under constant pressure. Combustion products (gases) enter the gas turbine, where the kinetic energy of the gas stream forms the mechanical work of turbine rotor rotation. The temperature of the gases in front of the gas turbine, depending on the array in the turbine, **is in the range of 1100-1500°C.**

After the gas turbine, the exhaust gases **enter the waste heat boiler at temperatures** 530 to 640°C.

Steam (or hot water) is generated by transferring thermal energy in a heat recovery boiler to deliver water and steam from the exhaust gases from the gas turbine. The gases emitted from the waste heating boiler are released into the atmosphere through the moss **110-120 °C** It is removed through the moss at temperature. Schematic diagram of GTU is shown in the figure below.

A basic heat diagram of the GTU power unit is shown in Figure 1. Heating of the mains water in the waste heat boiler **is carried out in accordance with the temperature table of 130/70** without burning the fuel with smoke gases after the gas turbine.

The basic thermal diagram of the GTU power unit is based on the monoblock principle: GE + KU - one gas turbine, one exhaust heat boiler. The fuel is burned in the combustion chambers of the gas turbine. The atmospheric air passes through a comprehensive air purification filter (CLE) and is mounted on a gas turbine compressor, where it is compressed to the desired parameters and then sent to the combustion chambers. The fuel coming up is natural gas. The combustion products from the combustion chambers enter the gas turbine, where they expand, performing the mechanical work used to drive the compressor and electric generator.

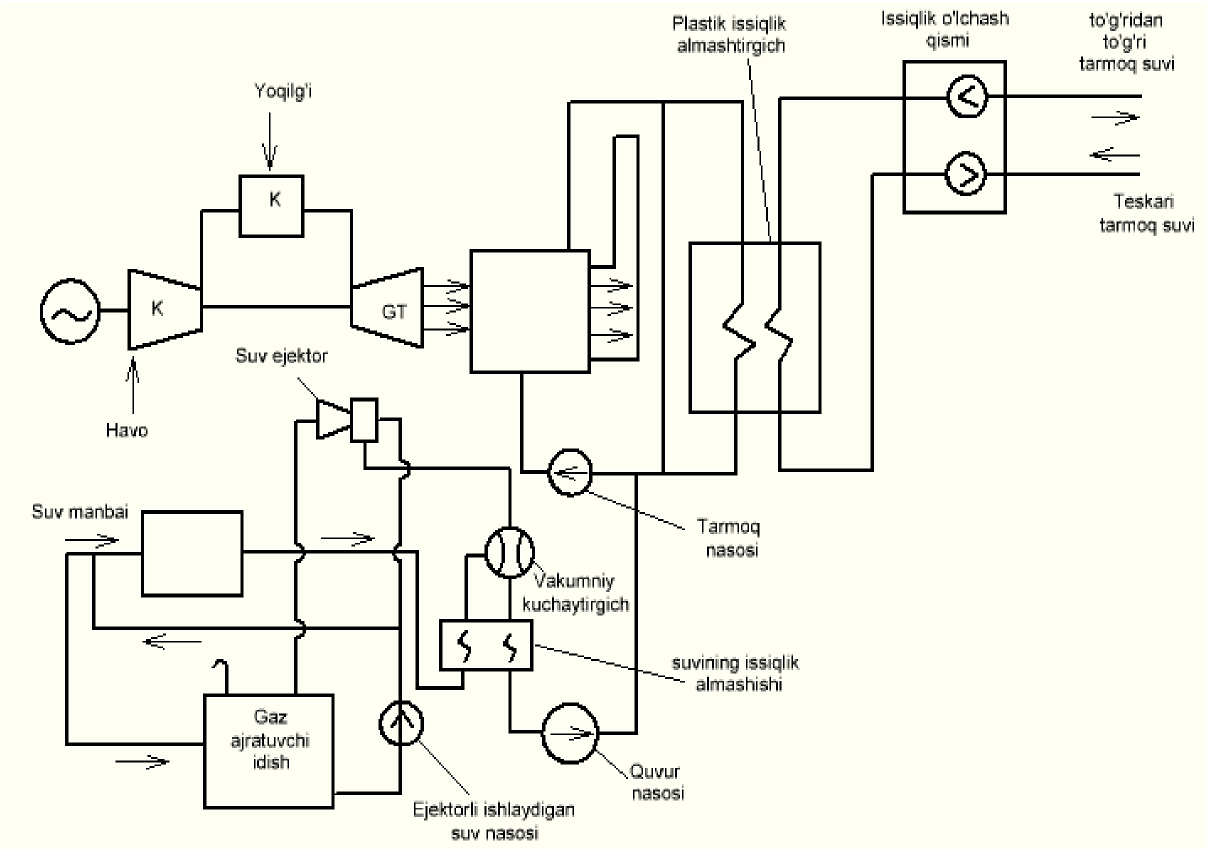

Figure 1 shows the main heat diagram of the GTU power unit

With a high temperature (approx. **523°C), the exhaust gases from the turbine** are transferred into the heat transfer boiler (KU). The water for being heated in a waste heat boiler with a temperature of about **130C**°C is supplied to the plate heat exchanger so that it heats the mains water of the existing heating system. The mains water is supplied to the plate heat exchanger through the mains pumps, which operate from the common pressure collector of the RK-3 mains pumps. After the plate heat exchanger, the total water with which the heated mains water is supplied to the collector RK-3, and then to the main heating network.

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To account for the consumption of released thermal energy, the heat meter is installed at the entrance to the plate heat exchanger and at the outlet of the heat exchanger.
After KU, smoke gases with a temperature of **120-150 °C** are sent to the turbine. The water cycle in a closed rotary cycle from the waste heating boiler to plate heat exchanger is done by rotary pump. The capacity of the mains pump is approximately **143 m3** per hour . The pressure generated by the circulation pump is **7 bar** (ieb).
The closed water chain of the recovery boiler, the chemically desalinated water from the planned water treatment plant has a capacity of **2.45 m3** per hour . The demineralized chemical, which is supplied from the water treatment device to the waste heat boiler, is pre-cleaned in a vacuum deerator and heated in replaceable water without salt water. The capacity of the vacuum deerator is 5 t/hr. The capacity of recharging closed water circuit of the waste heating boiler with chemical, non-desalination water will produce 2.45 m3/h. Chemical, mineralized water from VPU is carried out. Chemically demineralized water supplied from the VPU to the waste heat boiler for finishing is pre-deaerated in a vacuum deaerator. To ensure the high quality of the deaeration, the beaded water in front of the deaerator is heated in a heat exchanger with anhydrous water. The capacity of vacuum deaerator is 5 t/h.
Taking into account renewable and non-renewable factors, the general direction of gas turbine capacity and efficiency reductions illustrates the growth chart in Figure 11, which is typically an integral part of gas turbine installation specifications.
The change in the average annual GTU indicators relative to nominal characteristics over the calculated period of use (200 thousand hours of working time) is as follows:
For RK-3 GTU: **power will increase to 276.65 kW (from 7335.44 kW to 7158.79** kW), efficiency will increase by 0.82% **(from 33.6% to 32.78%),** the specific consumption of equivalent fuel for electricity supply will increase by **2.28 g /** kWh **(from 208.27 g / kWh to 210.55 g /** kWh), electricity supply to the grid will decrease by **2.16 mln kWh- hours (from 55.37 million kWh to 53.21 million kWh**). A comparative assessment of GTU nominal and average annual performance over the period beyond 200,000 hours is presented in Table 1.

GTU is nominal and averaged annual performance over the period after 200,000 hours

№	**Display Name**	**Unity Measure**	**Telugu Bulletin**	**~ 200 years ming soat Performance**
1	- Electricity generation	%	2,60	2,70
		mln.kvt.s	1,52	1,52
2	- for heat output	kvt.s.gkal	20,00	20,00
		mln.kvt.s	1,27	1.27
3	Power Supply from Gas Turbines	mln.kvt.s	55,65	53.48
4	- for power supply	g/kvt/s	208,27	210,55
5	- for heat output	kg/gkal	159,92	159,92
6	Fuel consumption, including	ming, tut	21,74	21,41
7	- for power supply	ming. tut	11,59	11,26
8	- for heat output	ming. tut	10,15	10,15

9	Annual consumption of natural	m3	18,81	18,53
10	Calorie content of fuel	kkal/m3	8 090,00	8 090,00
11	Losses on networks and transformers (0,5%)	mln.kvt.s	0,28	0,27
12	Power supply to the grid	mln.kvt.s	55,37	53,21
13	Efficiency of GTU-IES for power supply	%	59,0	58,4

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