

ENERGAS GROUP OF COMPANIES – THE FUTURE BEGINS IN THE PRESENT

On September 24, 2018, ENERGAS, the head company of ENERGAS Group, was eleven years old



ENERGAS COMPANY WAS ESTABLISHED IN 2007 FOR THE DESIGN, SUPPLY, COMMISSIONING AND MAINTENANCE OF PROCESS SYSTEMS AND PACKAGED UNITS FOR GAS TREATMENT. OVER THE YEARS OF SUCCESSFUL WORK, IT WAS POSSIBLE NOT ONLY TO EXPAND THE ACTIVITIES TO THE FORMAT OF THE ENERGAS GROUP, TO MAXIMIZE THE QUALITY OF PRODUCTS AND SERVICES, BUT ALSO TO EARN THE STATUS OF A RELIABLE PARTNER IN THE MARKET FOR ANY COMPANY THROUGH A PROFESSIONAL APPROACH. WHAT ARE THE RESULTS OF THE 11-YEAR JOURNEY? WHERE TO GO NEXT?

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Over the years, ENERGAS teammates have gone from the initial specialization in the segment of compressor equipment to complex projects of comprehensive gas treatment for any gas-using industry. These projects are based on both our own and adapted technical solutions for universal and individual use.

Today ENERGAS LLC is the parent enterprise of the ENERGAS Group of Companies, which act in concert under a common brand – based on a corporate code of professional principles and moral values, confirmed in practice.

The efforts of the head company are focused on the system organization and provision of current and future work of highly qualified specialists – in designing, manufacturing, supplying, commissioning and servicing packaged units and treatment systems of any type of gas – for the oil and gas industry, electric power industry, machine building, chemical, construction and other industries.

This is confirmed by a production report that ENERGAS publishes every autumn for the entire professional community, partners and customers of the company.

AT THE START OF THE NEW DECADE

The progressive development of ENERGAS Group continues through the deepening of professional knowledge and practical development of the modern specifics of the gas treatment process – based on maintaining high engineering responsibility for the quality of execution of the projects.

The accumulated experience is creatively synthesized with new engineering solutions for the efficient use of process equipment of the latest generation at large power



PHOTO 1. GTU-CHPP of Yarega oil-and-titanium field

ENERGAS has commissioned or prepares for launch 279 units for the gas treatment and gas compression

plants, facilities of small power industry, autonomous power supply complexes for industrial enterprises, APG gathering and transportation facilities, fields' auxiliaries power supply complexes, special purpose facilities (gas turbines test benches and technical training centers).

The results of ENERGAS for 11 years of work can be summarized as follows: the team successfully builds up organizational and engineering practice. In total, the Group has 144 projects in 35 regions of Russia and the CIS countries. Since 2007, 279 units have been commissioned or are being prepared for launch.

These units for various purposes, versions and modifications are combined into the ENERGAS equipment complexes of the following types:

- Multifunctional gas treatment and gas supply system;
- System of comprehensive associated gas treatment;
- Booster compressor station of fuel gas;
- Compressor station for associated gas pumping;
- Multi-module fuel gas treatment facility.

ENGINEERING SOLUTIONS AND FEATURES OF PACKAGING

Of the 33 gas treatment and gas supply projects that were completed by ENERGAS during the reporting period (10'2017–09'2018) or are currently at different stages of implementation, let us highlight some features of equipment packaging, as examples. And also we present a number of design and technological solutions.

Gas treatment and gas feeding system for the power supply complex "Yarega" of the LUKOIL-Komi LLC

At the Yarega oil-and-titanium field, the auxiliaries power supply complex on the basis of GTU-CHPP was constructed. The facility comprises three GTPP-25PA gas turbine power units produced by UEC-Aviadvigatel JSC with a total capacity of 75 MW. For issuance of the thermal power at the GTU-CHPP there are mounted three waste-heat boilers with total steam capacity of 121 t/h.

The launch of the power supply complex has provided growing need for electricity and steam of strategic field, increased the efficiency of its development and reliability of energy supply.

The fuel for turbines of the GTU-CHPP is natural gas from Kurino-Patrakovskoye gas condensate field. The designed gas parameters (at the inlet into turbines) in terms of purity, temperature, pressure and flow are provided by the multifunctional gas



PHOTO 2. Gas treatment and gas feeding system of ENERGAS for the power supply complex "Yarega"

treatment system of ENERGAS, which is composed of block-type gas treatment unit (BG TU), ACS of gas feeding as well as booster compressor station consisting of 4 units.

BGTU is a processing unit with maximum integration of the components on a single frame. Its main purpose is measurement of gas flow rate and gas filtration. BGTU is equipped with bilinear gas metering station (with ultrasonic flow meters) and filtration module. The degree of gas purification is 100% for liquid fraction and 99.8% for solids of size larger than 10 microns. The content of mechanical impurities at the outlet is not more 0.001 g/m³.

Additional functionality is gas pressure stabilization. For this purpose, BGTU is equipped with pressure reduction system. Contents of equipment also includes underground draining tank for gas condensate gathering; tank is equipped with a level sensor and a pump for condensate discharge. Capacity of BGTU is 15,780 kg/h (21,540 m³/h).

Gas treatment unit is located at an open site (inside easy-to-assemble enclosure); it is equipped with all necessary engineering systems. Operation mode is automatic. After pretreatment, the gas flow is fed to the booster compressor station.

BCS compress gas up to operating pressure in the range of 4.5...5 MPa and feed it to the turbines of GTU-CHPP. It consists of four compressor units (CU) of screw type. Capacity of each CU is 7,890 kg/h (10,770 m³/h).



PHOTO 3. Test bench for gas turbine engines AL-31ST

Units are placed in separate block-modules of arctic type equipped with life support systems (heating, ventilation and lighting) and safety systems (fire detection and fire fighting, gas detection, alarm).

Modern gas treatment system was developed on special project. Coefficient of operational reliability is 0.98. Inside CU and BG TU there is provided open space for easy and comfortable access to all assemblies and components what allows possibility for year-round quality performing of service activities.

For efficient monitoring, management and safe operation of this process equipment there is responds completed two-level automated control system – ACS of gas feeding (ACS GF). The main elements of the ACS GF are the following: local control systems of BCS and BG TU, control cabinet, the operator workstation, remote emergency shutdown. Internal and external connections are made using an Ethernet network as well as "S7-connection" and "Profibus" protocols.

As part of a long-term agreement with the customer, ENERGAS Group technical specialists carry out comprehensive maintenance of the gas treatment system, as well as the supply of components and consumables.

Gas compressor unit for the gas turbine engines test bench of UEC-UMPO PJSC

PJSC UEC-Ufa Motor-Building Production Association is the largest designer and manufacturer of

aircraft engines in Russia. In addition to aircraft engines UEC-UMPO manufactures products for the gas transportation industry and the gas turbine energetics:

- Gas pumping units GPA-16R and GPA-16-AL;
- Gas turbine units for power plants GTE-18, GTE-10/95 and GTE-10/95BM;
- Gas turbine drives AL-31STN for GPA;
- Gas turbine drives AL-31STE for GTE.

Since November 2012, the test bench, built by Ufa-Aviagaz JSC (subsidiary of UEC-UMPO) has been operating. The complex provides equivalent cyclic testing of gas turbine engines (GTE) AL-31ST used in gas pumping units and power plants.

The one of the key parameters of the drive is its service life, measured in hours and loads cycles. For example, AL-31STN – the base engine in the GPA – by its purpose should have an increased service life and high reliability under various operating conditions.

Unique in its features test bench of UEC-UMPO allows to test individual units and assemblies, as well as the entire design of the engine at a significantly accelerated cyclic loads in artificially created extreme conditions (in comparison with the natural operation conditions). On the test bench there are thoroughly tested design of rotating blades and frames of the high-pressure turbines, from operability of which there is directly depending general operational life and reliability of the drive.



PHOTO 4. Gas compressor equipment as a part of UEC-UMPO PJSC test bench

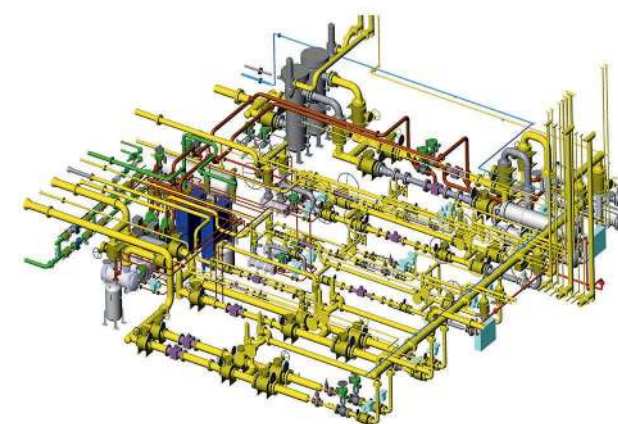


FIGURE 1. Layout scheme of equipment in the fuel gas treatment modules No. 1



PHOTO 5. The FGTF-1 is installed at the CGCTP site of East-Urengoy licensed area

As part of upgrade the test bench is equipped with a booster compressor unit (BCU) for uninterrupted fuel gas feeding for testable GTE according to the set parameters. BCU, supplied by the company ENERGAS will compress gas to the required operating level (2.8...3.2 MPa) and feed it to the gas generator of drives in the process of their testing.

The equipment was developed on a special project; it is designed for

and comprehensive test of BCU in conjunction with a gas turbine engine, as well as training of the operating personnel of the customer.

For ENERGAS this is the fourth similar project. Earlier, by compressor units there were equipped gas turbine's test bench of Proton-Perm Motors PJSC, UEC-Gas Turbines JSC and Nevsky Zavod CJSC.

During the year, ENERGAS Group specialists performed works at 33 sites – from Kaliningrad to Vladivostok

operating under high intensity of starts and shutdowns as well as various duration of testing. Capacity of BCU is 6,500 m³/h.

Supply set also comprises a two-tier automated control and regulation system (ACRS) which is integrated into APCS of the test bench. The first level of ACRS is BCU control module housed inside the block-box of the unit and separated from the process part (machine room) by gas-tight fire-resistant partition. The second level is a remote control (workstation – WKS) located in the control room of the facility.

Phased commissioning of the fuel gas BCU is carried out by the company ServicENERGAS (ENERGAS Group). There are being performed erection supervision, start-up and adjustment works, individual testing of equipment,

Multipackaged fuel gas treatment facility for the facilities of East-Urengoy licensed area of the Rospan International JSC (Rosneft)

The East-Urengoy licensed area is located in the Purovsky District of the Yamal-Nenets Autonomous Area. With the commissioning of this area, the annual amount of gas production by Rospan International will increase almost fivefold and reach a level of over 19 billion cubic meters.

In order of full development of the field, a complex gas and condensate treatment plant (CGCTP) is being set up here. The designed capacity of the facility in terms of the volume of natural gas treatment will be:

- 16.7 billion cubic meters of dry gas per year;

- Up to 4.5 million tons of stable gas condensate;
- Over 1 million tons of propane-butane fraction.

CGCTP is equipped with a multipackaged fuel gas treatment facility (FGTF) of ENERGAS.

This FGTF will perform filtering, metering, heating, reduction and in parallel mode will feed gas (with different parameters in terms of pressure, temperature and flow rate) to the facilities of main and auxiliary purposes. Among them there is a boiler house, a technical propane-butane purification unit from methanol, a low-temperature separation unit, a methanol regeneration unit, intake flow lines, a flare unit, a booster compressor station of low-pressure gases, and a condensate stabilization unit.

The FGTF includes two fuel gas treatment modules (FGTM). Each module consists of separate block-boxes with equipment that are docked together in a single block-building with a common roof.

FGTM-1 is the main; the range of its design capacity for gas is 93 ... 90,400 nm³/h. Fuel gas treatment module No.2 is standby; the installed capacity of FGTM-2 is 93 ... 32,612 nm³/h.

The fuel gas treatment facility was designed and manufactured taking into account the climatic conditions of the region and is designed for intensive operation mode.



PHOTO 6. Grozny TPP under construction

It is important that the ENERGAS FGTF will supply fuel to a new auxiliaries gas turbine power plant under construction at the CGCTP site. The 105 MW GTPP will provide electricity for the East-Urengoy licensed area's facilities of production, processing and transportation of the oil, gas and gas condensate. The new power plant consists of seven Titan 130 gas turbine units (Solar) with rated capacity of 15 MW each.

Booster compressor station as a part of the Grozny TPP (OGK-2)

The construction of a thermal power plant is carried out in the city of Grozny on an area of more than 20 hectares in the territory of the former Grozny CHPP-3. The basis of the power units of the Grozny TPP is two Siemens SGT5-2000E gas turbine units (GTU) with a capacity of 180 MW each. The installed electrical capacity of the plant is 360 MW.

The operating company is PJSC Wholesale Generation Company OGK-2. The project is being implemented by the Gazprom Energoholding Group within the framework of a system of capacity supply agreements (CSA). The Grozny TPP is the final CSA project of the Group's companies.

The main and reserve fuel for turbines is natural gas. Continuous supply of fuel gas to the GTU will be provided by a BCS consisting of three Enerproject modular compressor units (CU).

All the works on commissioning of the BCS are being conducted

by the leading engineers of the ENERGAS Group, which is the official representative and partner of the Swiss company Enerproject SA in Russia.

The gas pressure at the CU inlet is 0.85 ... 1.2 MPa, at the outlet – 2.4 ... 2.5 MPa. The capacity of each booster compressor (rated – 34,200 kg/h, maximum – 39,240 kg / h) is up to 100% of the maximum flow of gas fuel per turbine. Two operating units give in total the necessary gas flow to two gas-turbine power units. The third compressor is ready to be switched on by ATS (automatic transfer switch).

Automated control systems of CU are placed in separate containers located in the immediate vicinity of the block-modules with process equipment. Local ACS is combined using the group control function.



PHOTO 7. Block-module with process equipment and air cooler unit of CU

As a result, the compressor station is capable of automatically maintaining the required parameters of gas fuel at the inlet to the GTU control unit. In the event of failure of one of the two operating CUs, the remaining unit is maximally quick (no more than 3–5 seconds) gaining rated capacity, and the standby unit for no more than 40 seconds ensures the necessary BCS capacity for the operation of power units without reducing the total load of GTU.

Complex of fuel supply equipment for the GTU-CHPP "Vostochnaya" in Vladivostok (RusHydro)

On September 10 of this year, the GTU-CHPP "Vostochnaya", created by RusHydro, was put into operation. This is the first large power facility built in the last 45 years in the Vladivostok.

A power plant with electric capacity of 139.5 MW and thermal capacity of 432 Gcal / h will provide the capital of the Primorye Territory with electricity, heat and hot water. The designed annual electricity output is 791 million kWh, heat energy – 1.377 million Gcal.

CHPP "Vostochnaya" is equipped with efficient equipment with high technical indicators. There are three air-craft derivative gas turbine units produced by General Electric – GTUs of the type LM6000 PF DLE with a power boost system SPRINT. This technology helps to reduce the temperature in the combustion chamber of the turbine due to the spraying of fine-dispersed water



PHOTO 8. Process compartment of block-type gas treatment unit for the GTU-CHPP "Vostochnaya"



PHOTO 9. Gas receiver with a volume of 25 cubic meters

dust. In this case, the compressor compresses and supplies more air, which in turn increases the output power of the turbine.

In addition, each unit is equipped with a combustion chamber type DLE with a system for dry suppression of nitrogen oxide emissions in the entire power range, which allows maintaining a low level of emissions even with incomplete loading of the turbine. GE also supplied modular, multi-stage static filtration systems (air inlet filter – AIF) equipped with

The block-type gas treatment unit (BGTU) manufactured by LLC BelgorodENERGAS (part of ENERGAS Group) is a multifunctional process unit. The main purpose is flow measurement and gas filtration. The rated capacity of BGTU is 40,000 m³/h.

BGTU is equipped with a gas metering station with flow meters, a highly efficient separation system with coalescing filters-scrubbers, a condensate drainage system with a drainage reservoir. The degree

Each CU is equipped with a two-level capacity control system (bypass line and spool valve control). Compressor units are in their own all-weather shelters; are equipped with working and emergency lighting systems, space heating and ventilation, gas detection and fire extinguishing systems, individual oil supply and gas cooling systems.

The gas treatment and gas feeding system also includes a gas receiver with a volume of 25 cubic meters designed to smooth the pressure pulsations in the gas distribution net. When the fuel supply is cut off, the receiver ensures the smooth shutdown of turbines of the power plant.

ENERGAS equipment provides the design gas parameters on purity, temperature, and pressure and flow rate

an anti-icing system that will ensure reliable operation of the GTU in winter conditions.

From turbines, exhausted hot gases enter waste-heat boilers, where water is heated – this increases the overall efficiency of fuel use. To issue heat, three peak water-heating boilers are installed, and for the production of steam for industrial purposes – two steam boilers.

Main fuel for the power plant is natural gas. The fuel supply for power units of the CHPP "Vostochnaya" is implemented by the ENERGAS gas treatment system (GTS) located at the site of gas facilities.

GTS ensures the necessary quality of gas in accordance with the design parameters on purity, temperature, and pressure and flow rate. The main elements of system are a block-type gas treatment unit and a booster compressor station consisting of three units.

of gas purification from mechanical impurities and droplet moisture (larger than 10 μm) reaches 99.98%.

The packaged unit is housed in a separate sound- and heat-insulated module with integration of equipment on a single frame; it is equipped with life support and safety systems.

After filtration and metering, the gas enters the BCS.

Booster compressor station supplied by the company ENERGAS serves to compress and feed fuel gas to the GTU turbines at working pressure of 4.81 MPa. Each of the three compressor units has capacity of 18,000 m³/h.

In two-stage CUs there is used technology of gas compression in two steps without intermediate cooling. This allows the BCS stably operate over the entire range of the suction pressure changing, regardless of the feeding line.

BCS of hangar type for the GTPP of South-Nyurymyskoye field of Surgutneftegas PJSC

Since the end of 2017, gas turbine power plant (GTPP) for own needs has been operating at the South-Nyurymyskoye field of Surgutneftegas PJSC.

GTPP operates in the cogeneration cycle; it generates electricity and heat for the field infrastructure. The power plant consists of two Ural-4000 power units (manufactured by the UEC-Aviadvigatel JSC) with electric capacity of 4 MW each made on the basis of GTU-4P gas turbine units. For issuance of the thermal power there are mounted waste heat exchangers with total capacity of 8 MW.

The new facility operates around the clock, year-round. The GTPP equipment has full redundancy. This excludes its full shutdown when conducting preventive and repair works.



PHOTO 10. Compressor units feed associated gas to the South-Nyuryskaya GTPP



PHOTO 11. BCS of hangar type is placed in a separate capital building

Being located directly at the field, the GTPP uses associated petroleum gas as fuel. Compression of APG and its feeding to the turbines under required operating pressure of 2 MPa are provided by the booster compressor station. BCS of hangar type comprises two compressor units on base of screw oil-filled compressors. Capacity of each CU is 6,000 m³/h.

Gas purification at the inlet of each compressor is implemented by high-efficient separator – two-stage filter-scrubber with automatic drainage system. The process scheme of the BCS also provides for the provision of a set gas feeding temperature to the GTPP.

CUs are placed inside a separate capital building. Operation mode of the units as a part of the facility of oil and gas production complex is uninterrupted with scheduled shutdowns for maintenance.

The erection supervision, start-up and adjustment works, individual tests, and operability check of the BCS during comprehensive testing of gas turbine power plant were performed by the ServiceENERGAS.

System of comprehensive gas treatment for the power units of Pregolskaya TPP of the LLC Kaliningrad Generation

In Kaliningrad, the construction of the Pregolskaya TPP continues. On September 24 this year, ahead of schedule, the 1st power unit was commissioned. The customer

of the construction is Kaliningrad Generation LLC. The project is managed by LLC Inter RAO – Electricity Generation Management. The general contractor is Inter RAO – Engineering LLC.

The project implementation will make Kaliningrad's power grid more maneuverable. The total installed capacity of the TPP is 454 MW. This will be the most powerful power plant of the new generating, which will become the basis of the energy security of the entire region.

Total run time of operating ENERGAS units is more than 10 million hours

The power plant consists of four combined cycle gas turbine units. Each CCGT includes the following equipment:

- 6F.03 gas turbine with capacity of 77.9 MW produced by the Russian Gas Turbines LLC;
- Generator (SPA Elsib);
- Waste-heat boiler (Machine-Building Factory of Podolsk JSC);
- Steam turbine (Power Machines PJSC).

Fuel supply for 6F.03 turbines is provided by gas treatment unit (GTU), manufactured by ENERGAS Company. GTU is installed at the territory of the Kaliningrad CHPP-2, which is adjacent to the TPP under construction. Gas treatment unit is a process unit, including several block-

boxes with equipment for various purposes, which, when assembled, are docked together in a single building with a common roof. An exception is the inlet filtration module, which has an outdoor design on open frame.

In addition to the inlet filtration module, the unit is equipped with a fine gas purification system, a condensate drainage unit (with a 10 m³ drainage tank), a gas metering station with ultrasonic flow meters, a gas heating unit, and a

reduction system. To determine the component composition and calorific value of fuel, the GTU is also equipped with a continuous on-stream gas chromatograph (calorimeter) with a sampling device.

Gas pressure at the GTU inlet is 1.2...4.14 MPa. The rated capacity of the unit is 106,000 Nm³/h.

ENERGAS also supplied for the Pregolskaya TPP a booster compressor station consisting of four block-modular units. BCS will provide gas supply to the power units if the pressure of the fuel gas entering the power plant is below the design parameters set by the manufacturer of gas turbine equipment.

The pressure on the discharge line of CU varies in the range

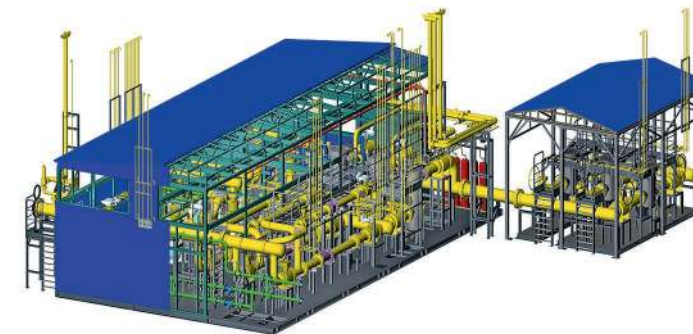


FIGURE 2. 3D model of ENERGAS multipackaged gas treatment unit. The main module and the inlet filtration module



PHOTO 12. Gas treatment unit will provide fuel for the power generating units of Pregolskaya TPP in Kaliningrad

2.6...3.45 MPa. The unit capacity (gas flow rate) of units is 35,500 Nm³/h.

The gas filtration system in the CU is reinforced – an additional (insurance) gas fine filter is built into each block-module. The oil vapor analyzer in gas is installed on the common BCS outlet manifold (permissible level – no more than 0.5 ppm).

The cascade of successive gas coolers and gas heaters integrated in the process flow diagram of the CU provides a separation of condensate and a stable maintenance of the designed fuel temperature for CCGT turbines.

Gas treatment unit and booster compressor units are fully

automated. Their automated control systems implement launch (and preparation for start), shutdown, and maintaining the optimal operation mode; they control the process parameters; they provide automatic protection and alarm system; they handle the parameters of the workflow and emergency events with the issuance of information via a standard exchange protocol.

The local ACSs of the GTU and CU have been output into a common control module placed in a separate enclosure and mounted at the site of gas facilities of the power plant. There are connected uninterruptible power supplies;

software is installed and configured. The complex is integrated with the upper level of APCS and provides remote equipment control, indoor gas hazard monitoring, output of status information for all elements and systems to the operator panel.

GTU, BCS and control module constitute a single gas treatment and gas supply system of the Pregolskaya TPP. ●

Each implemented project is a professional life stage. Over the past years, ENERGAS specialists have firmly learned: without full commitment and concentration of experience, strength and will, success is impossible. Such a personal approach and a collective tradition of solid teamwork guarantee the realization of the most daring technological innovations and large-scale projects.

The ENERGAS team is grateful to all customers and partners for their joint work and cooperation in the segment of process equipment for integrated gas treatment.

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PHOTO 13. BCS consisting of four units is included in the comprehensive gas treatment system