



REFERENCES TO TYPICAL SOLUTIONS FOR ENERGY COMPLEXES BASED ON GAS EQUIPMENT



ELECTROSYSTEMS
TECHNICAL HOLDING

Company Profile

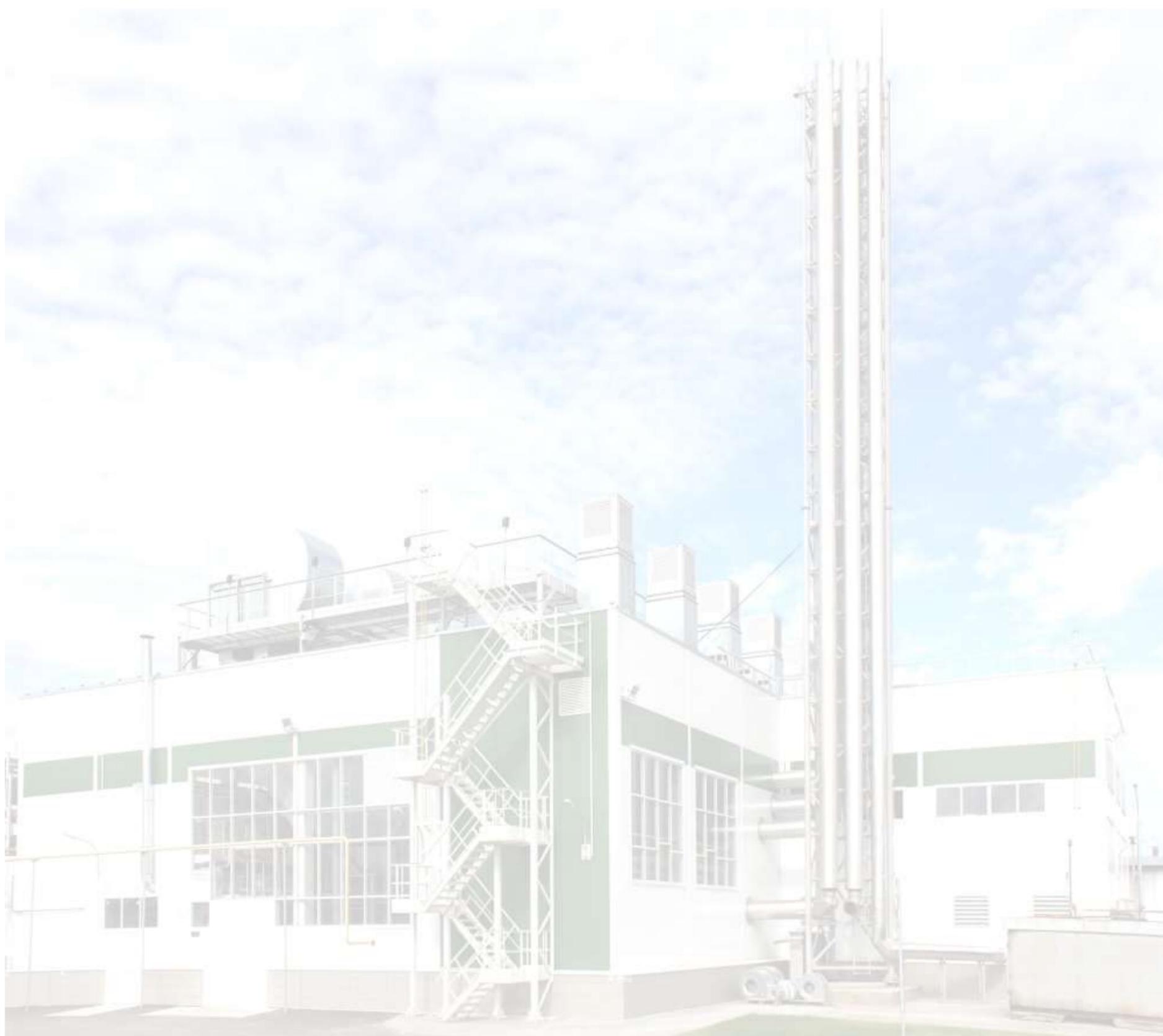
Electrosystems Technical Holding was founded in 1994, and is now one of the market leaders in uninterruptible, autonomous and standby power supply, providing design, equipment supply and technical support in the entire territory of Russia and the CIS.

The Holding has its own production site, which ensures quality control at all manufacturing stages and decreases timing of the orders. Production facilities of the company allow for manufacture of modular diesel, gas engine and gas turbine plants, automatic power installation control systems, switchgear equipment.

For years of operation the Holding companies have implemented dozens of projects of diesel power plants, mini CHP

plants on the basis of gas gensets and microturbine units, uninterruptible power supply systems. We are proud to have such customers as Lukoil, Rosneft, Megafon, Rostelecom, MTS, North West Telecom, VTB Bank, Sberbank, Russian Railways, BCC Company, Polysan, etc.

Electrosystems TH is a strategic partner of the leading foreign and national manufacturers of reliable modern power equipment such as MWM, GE Jenbacher, FG Wilson, Eaton, Capstone, etc. Quick service support is provided by a network of service centers belonging to the Holding located in St Petersburg, Moscow, Rostov-on-Don, Irkutsk, Ufa.



Application Solutions by Electrosystems TH

Power Supply in the Oil and Gas Sphere

One of the most important requirements to power supply of production and transportation enterprises in the oil sphere is reliability. An interruption in power supply of such consumers for over 30-60 seconds may cause an interruption of oil production for up to several hours.

Specialists of Electrosystems TH have gained considerable experience of building power plants for oil production companies allowing to avoid mistakes in selection of components, design and installation. Specifications of power plants produced by the company ensure maximum reliability and cost effectiveness.

The Company offers its Customers the following developed solutions:

- Power plants, including standby diesel plants, with heat recovery systems and boiler equipment, with power of 100 kW to 4300 kW (single power), for application at mining sites;

- Complex modular and stationary power plants with power of 100kV to 50 MW to be used as the main power supply;
- Power plants fuelled by oil gas, including gas conditioning systems;
- Control systems (APCS) for power plants with multiple units, and supply of ancillary equipment in containers.
- Control and management systems of energy complexes;
- Hybrid power supply systems based on renewable energy sources (wind-solar-diesel power plants for remote controllers and automation and mechanical systems of the piping.



Energy complex, Samburg



In April 2012 operation of the Samburgsky oil and gas condensate field was started.

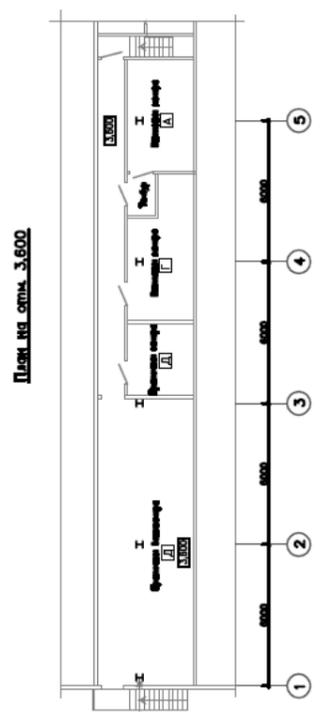
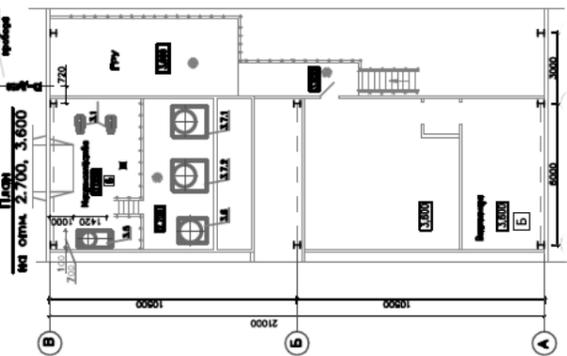
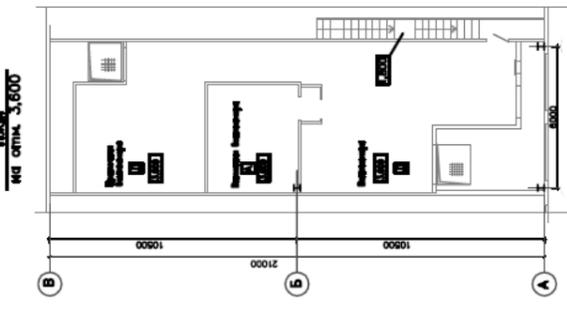
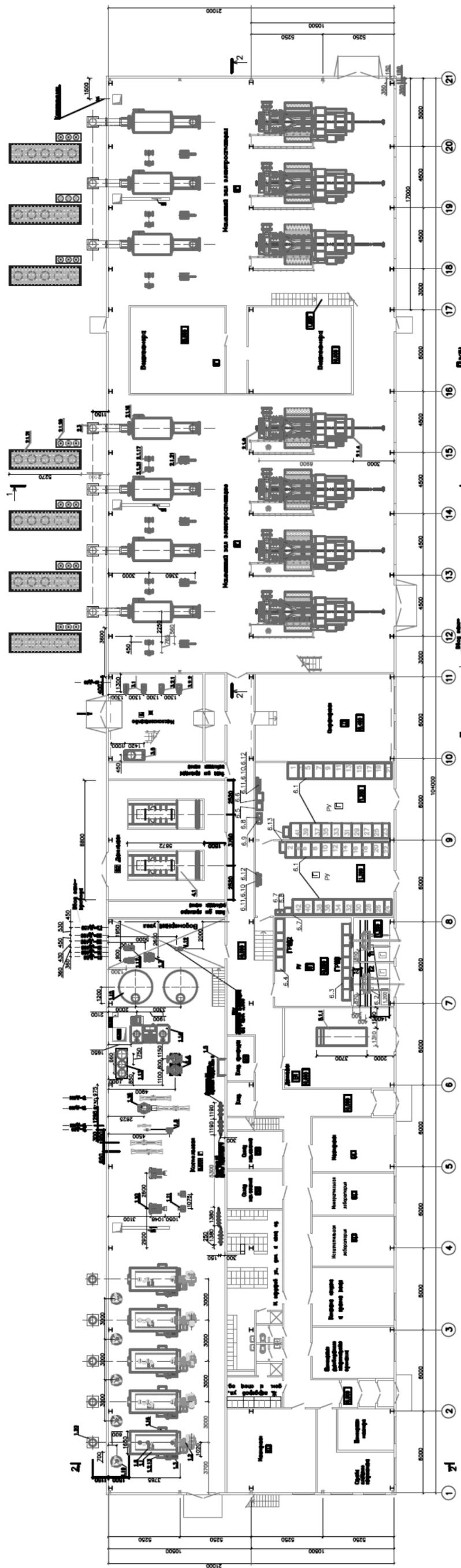
Specialists of Electrosystems TH designed an energy complex for Samburgsky field to generate 24 MW electric power and 48MW heat power.

The structure of the energy complex ensures comfortable operation of all equipment under highly severe climatic conditions.

Process schemes provide for the possibility to supply the most critical consumers both from gas and diesel gensets, as well as for parallel operation of gas and diesel gensets to start consumers with high inrush currents.

All work was performed in compliance with Russian regulations and European quality standards ISO, as well as with additional internal standards of Eni and Enel.





Energy complex, Nakhodka



In 2004 Electrosystems TH was one of the first in Russia to build a turnkey fully automatic energy complex on the basis of gas and diesel generating sets by MWM (former Deutz) with electric power of 6 MW, and boiler equipment by LOOS (with total power of 12 MW).

The complex designed for electric and heat power supply of the field in the polar region was built in record time. A peculiarity of this complex is its ability to operate in the island mode with loads having large inrush currents (pumping equipment of the field) without increasing power of gas generating units. In the engine room there are four gas engine generators with single power of 1.35 MW and heat recovery from the engine cooling system. The energy complex has been providing uninterrupted supply of power and heat for Nakhodka field since 2004.



Energy complex for JSC "NICEVT", Moscow



Energy Complex on the basis of four open MWM gas gensets, type TCG2032V16, with heat recovery system is being turn-key constructed by specialists of Electrosystems TH.

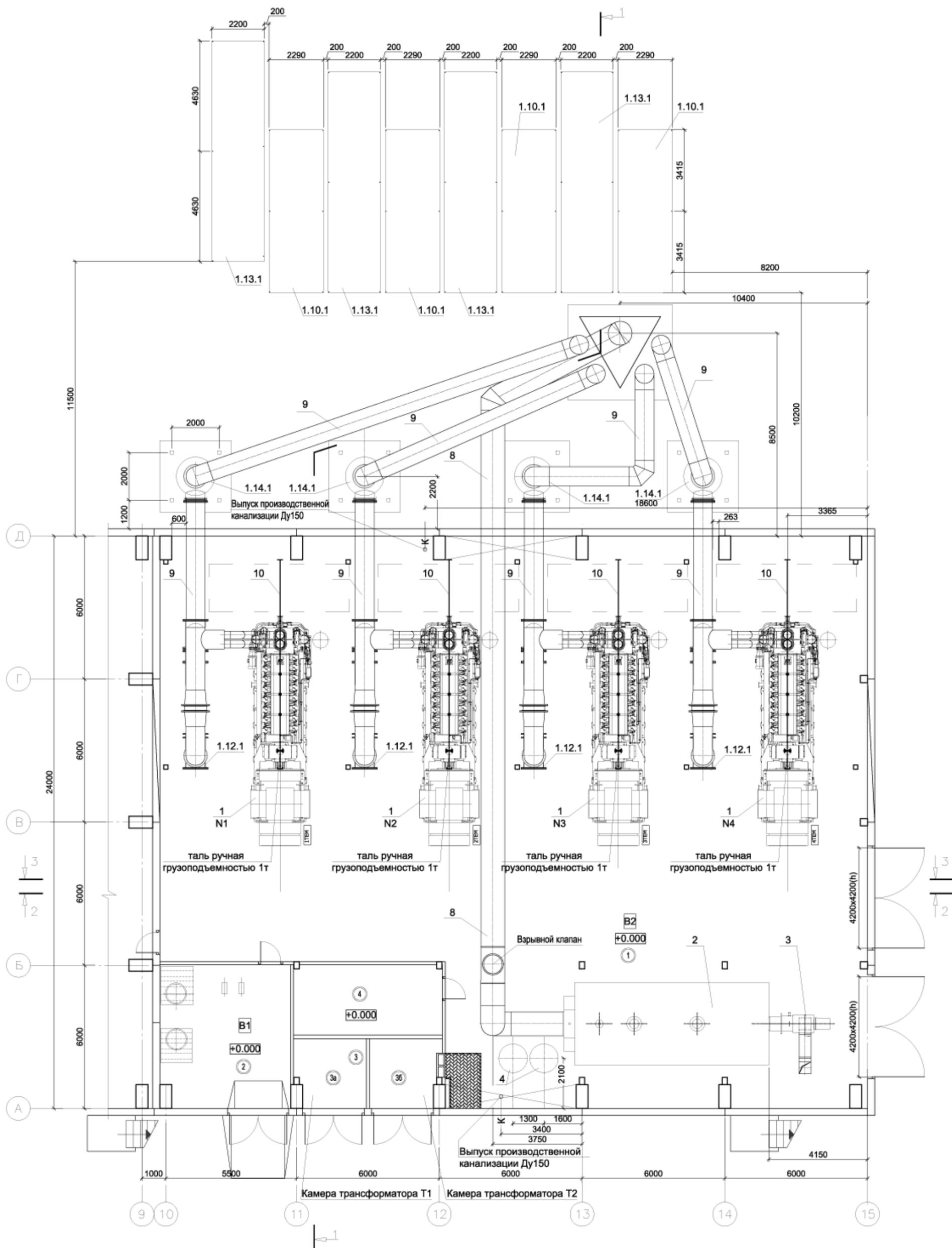
CHP plant is installed in a separate premises located at the non-operated building part and separated from the operated building part by the firewall.

Energy complex also includes Viessmann hot water boiler of 16,5 MW heat power and Weishaupt automatic burner with frequency control of the ventilation station. The boiler automatic equipment maintains system water temperature at the boiler outlet depending on ambient air temperature.

Total electric output of Energy complex is 17,2 MW, total heat output is 34,5 MW.

Total scope of works scheduled to be performed until 2017 includes surveys, design, supply of equipment, construction and installation works, commissioning and putting Energy Complex into operation.





Standalone Power Supply of Pharmaceutical Enterprises

Energy complex, Scientific Technological Pharmaceutical Firm “Polysan”, Saint-Petersburg



STPF “Polysan” is a Russian manufacturer of unique medical products that significantly contributes to implementation of target development programs for the Russian pharmaceutical industry.

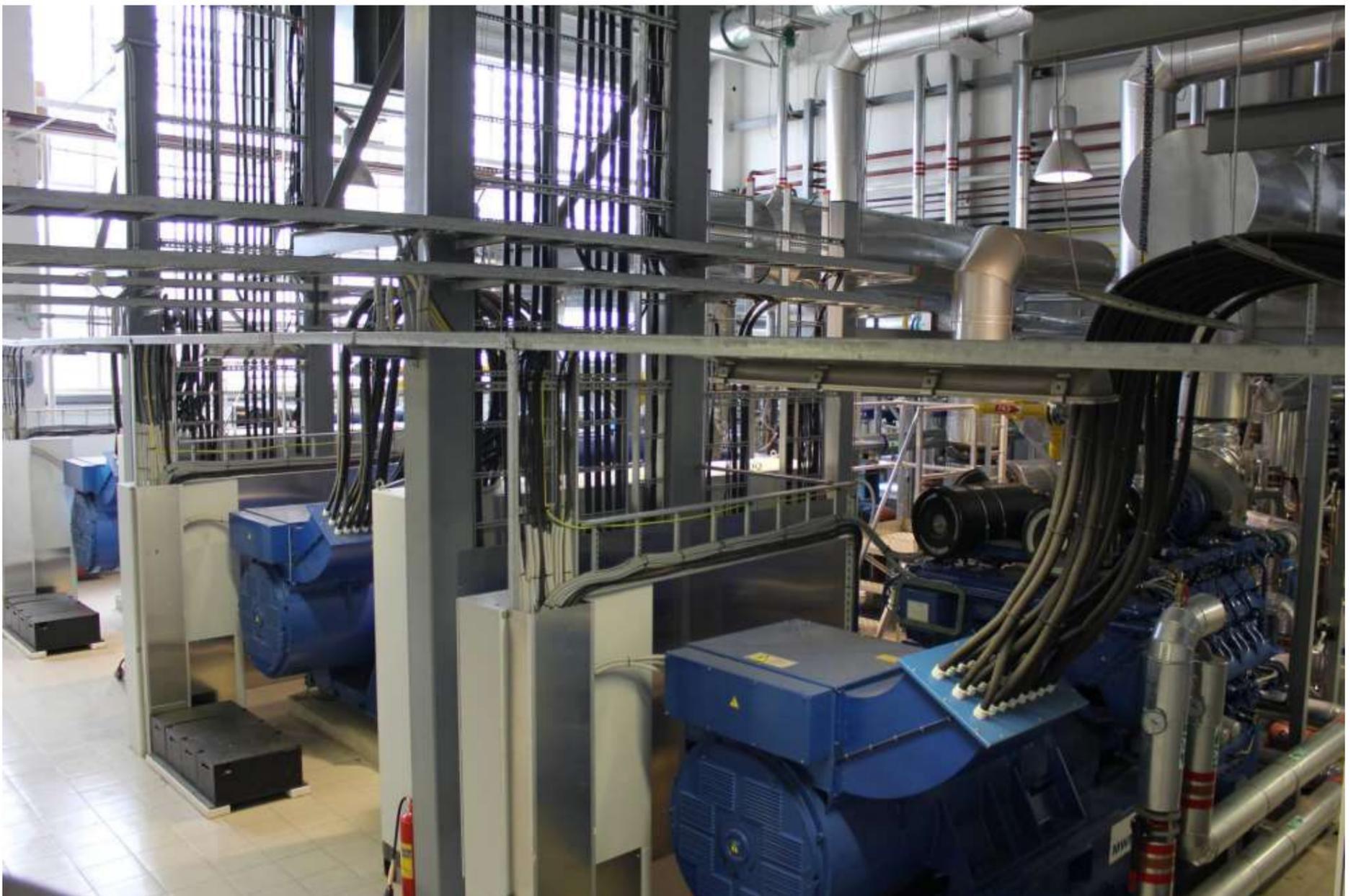


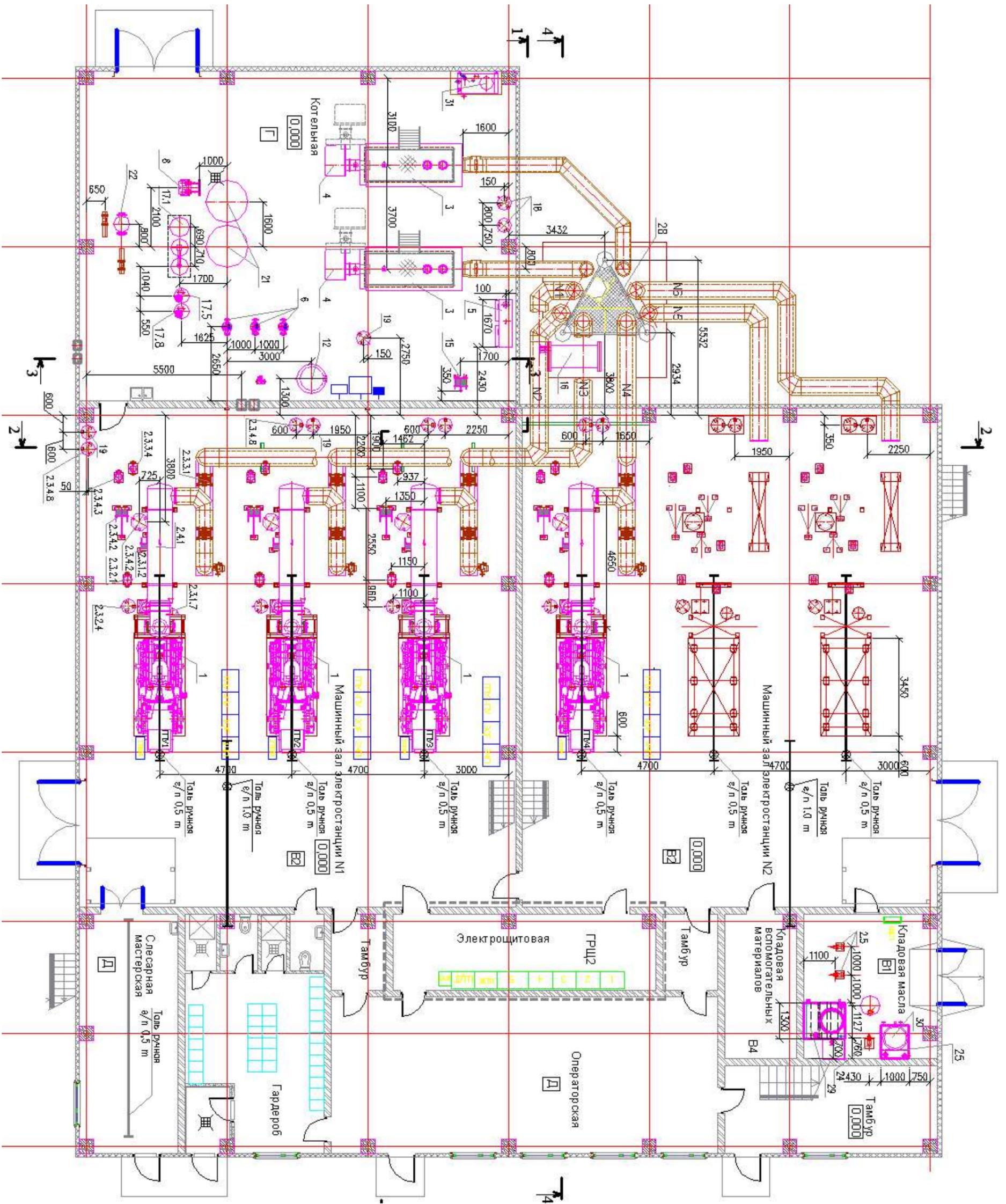
The factory energy complex is designed by Electrosystems TH on the basis of six **MWM** gas gensets, type TCG 2020 V12K, and two hot water boilers by **BUDERUS** with double fuel burners by **DREIZLER**. The total installed electric power of the complex is 6420 kW, and total heat power is minimum 12 MW. Currently the first stage of the power complex is finished: there are four gas gensets and two hot water boilers installed and commissioned.

The second stage of construction provides:

- Installation of 2 MWM gas gensets, type TCG2020V12K, with heat recovery system of 1125 kW electric output each, 0,4 kV and of 1338 kW heat output each at 100% load;
- Upgrading of the installed control system for power plants of STPC Polysan Ltd.. Upon upgrade completion, 6 gas gensets and 3 diesel gensets will operate for total load.







Standalone Power Supply of Industrial Facilities

Among our customers there are a lot of industrial companies that due to certain reasons are unable to connect to centralized grid. For every customer we find a tailor-made individual solution, the most efficient and fully complying with his requirements.

The main goal of every factory is to decrease their product prime cost which includes electricity and heat costs. Construction of a private power plant can significantly decrease these expenses. Advantages of a standby power plant are evident. In the first place, these are efficient fuel consumption by means of cogeneration (or trigeneration), increased electric power supply reliability and environmentally friendly electric and heat power generation.

Energy complex for an industrial site, Krasnodar



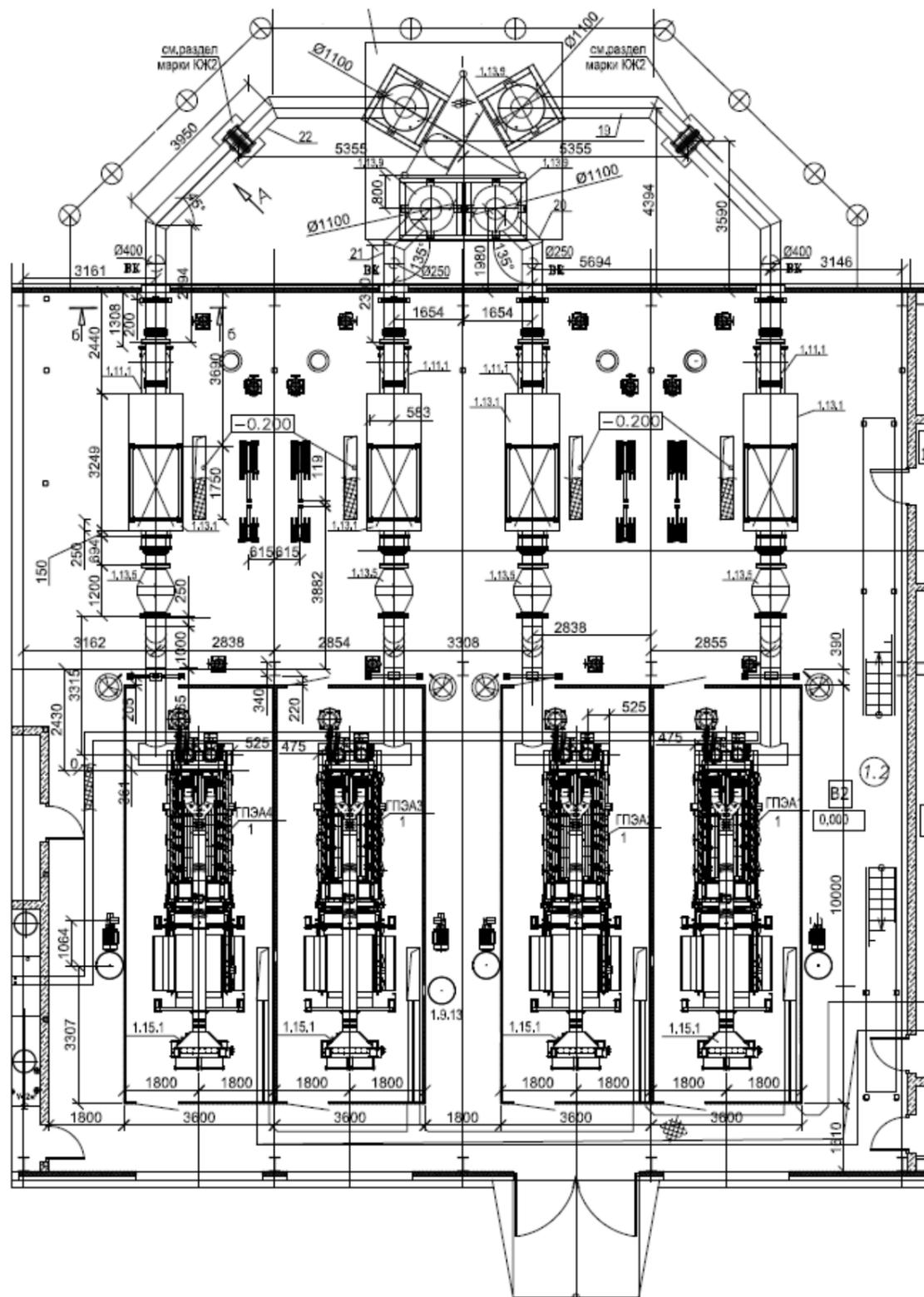
In 2016 Energy complex for CJSC "Tander" designed for heat and power supply of industrial site "Solnechnaya 15" has been constructed by specialists of Electrosystems TH.

Four MWM gas gensets, type TCG 2020 V20, of 2 MW electric power with heat recovery system and of 2,16 MW heat power are used as main generators. These gas gensets are installed in sound enclosures.

As stand-by power supply diesel genset P2500-1X by FG Wilson of 2 MW is used.

Energy complex operates on a year-round and continuous basis, in stand-alone (island) mode and parallel to the grid without power flows.

Total electric output of this Energy complex is 8 MW and total heat output is 8,6 MW.



Energy complex for Logistics Center, Zelenodolsk



Block-modular Energy complex is turn-key constructed by Electrosystems TH for Tander CJSC. It is designed for electric and heat power supply of food and non-food warehouse located in the Republic of Tatarstan, the Zelenodolsk District.

As main source of electric and heat power supply, MWM modular gas cogeneration set, type TCG2020V12, of 1,2 MW electric output and 1,224 MW heat output at 100% load with 10 kV alternator is installed.

This modular-assembly Energy complex includes:

- Block-modular gas genset;
- Gas distributing unit;

- Block-modular 10 kV indoor switchgear;
- Block-modular heat metering unit.

Energy complex operates on a year-round and continuous basis, in stand-alone (island) mode and parallel to the grid without power flows (combined mode).

Power supply of Energy complex provides possible synchronization of gas genset with one of the grid inputs or stand-by diesel genset 1.

Energy complex for Logistics Center, Shakhty



Electrosystems Technical Holding has performed “turn-key” construction of block-modular energy complex designed for electric and heat power supply of food and non-food warehouse with the facilities for servicing trucks and some warehouse facilities (not more than 10 and located further than the warehouse) in the Rostov Region. The current electric power supply system has also been reconstructed. The Customer is Tander CJSC, one of the biggest retailers at the RF territory.

As main source of electric and heat power supply, block-modular MWM cogeneration gas genset, type TCG2020V12, of 1,2 MW electric output and of 1,224 MW heat output at 100% load with 6,3 kV alternator is installed.

Energy complex includes a block-modular gas genset, gas distributing and pressure reduction unit and block-modular 6,3 kV indoor switchgear.

Energy complex operates on a year-round and continuous basis, in stand-alone (island) mode and parallel to the grid without power flows (combined mode).

Energy complex for Logistics Center, Togliatti, the Samara Region



Energy complex is designed for electric and heat power supply of the logistics center consumers: food and non-food warehouse and transport company facilities, located in the Samara Region, the Stavropol District.

As main generators, MWM gas gensets, type TCG2020V20, of 2 MW electric output each, 10kV voltage and heat recovery system of 2, 048 MW at 100% load are installed.

As stand-by power supply, P1250P3 diesel genset by FG Wilson of 1 MW electric output, 400/230V, on the base frame, with EagyGen 3500 control panel is installed.

Total electric output is 7,0 MW and total heat output is 6,144 MW.

Energy complex operates on a year-round and continuous basis, in stand-alone (island) mode and parallel to the grid without power flows (combined mode).

The control system developed and implemented by Electrosystems Technical Holding specialists provides this energy complex with operational control and management. Automation control and monitoring system allows collecting process, warning and emergency alarms from all the equipment control units and devices, storing these data in specialized archives and transmitting them to an operator's computer work station in a graphic form. An operator can control any equipment and units remotely with the help of this system.

“Automatic load sharing” system (ALS) used in this energy center provides monitoring of the electric power consumed under the connected loads in the electric power distribution system, remote control of the switching devices, identifying consumers' priorities and their automatic cutoff in case if one of the power supply sources trips, to prevent genset shutdown when overloaded and at a sudden load surge.

Energy complex for a poultry processing plant, the Penza region



In 2013 specialists of Electrosystems TH have completed the turnkey construction project of energy complex for electric distribution company which supplies electric and thermal power to a poultry processing plant.

The main power source for consumers of the plant located in the Penza region is distribution transformer sub-station powered by two inputs of the town mains. 3 MWM co-generation units, nominal power capacity of 2000 kW each, voltage of 10,kV, are used as additional power sources included in the energy complex. Factory-made containerized units equipped with heat recovery system with total thermal output - 6,285 MW, and all necessary auxiliary systems.

Implementation of 3 MWM gas generating sets with total installed capacity of 6MW as a part of the energy complex allows the following:

- to meet together with the town mains power requirements of the site in standard operating conditions;
- operation of all gas gensets at full load gives the possibility of transferring up to 6000kW of generated power to the energy system;
- to meet power requirements of all site consumers in all emergency situations;
- due to standby power it is possible to provide power supply of the most of site consumers in case of emergency or repair of one of the gensets, or in case of emergency situation at the transformer sub-station;
- to transfer all recovered heat for the plant supply.









Energy complex for a fish processing plant, Salekhard

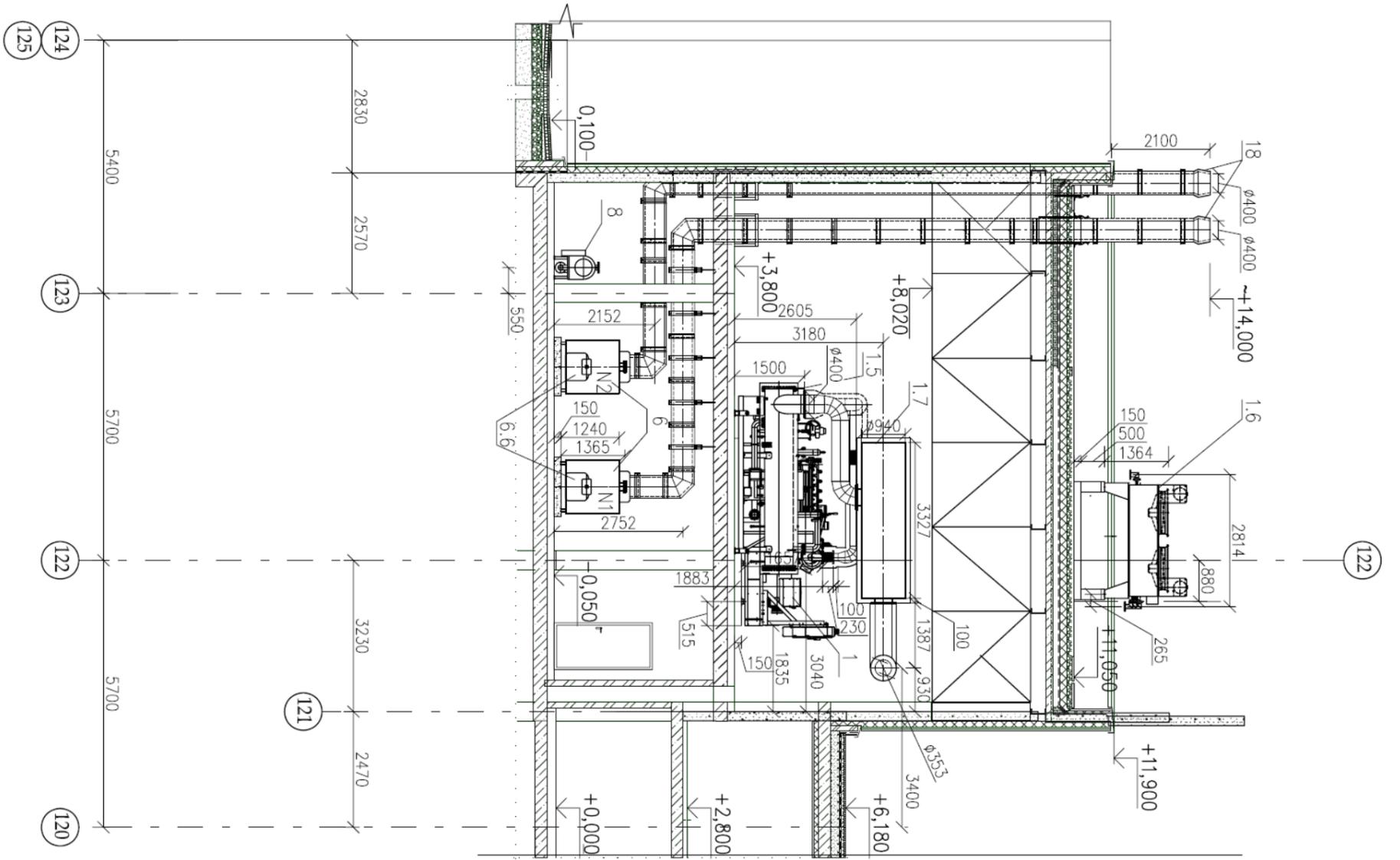
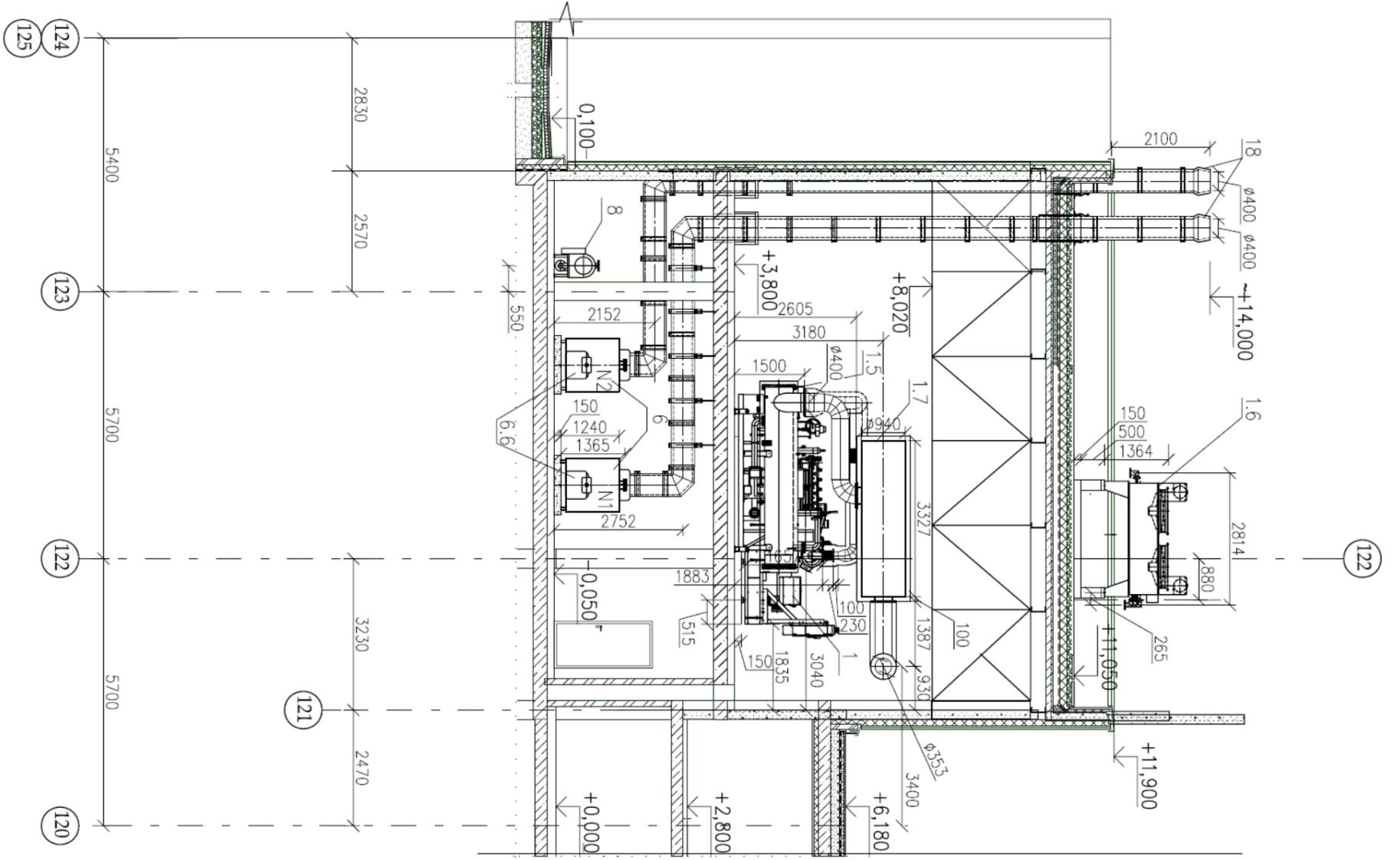


The energy complex includes two gas engine generators PG750B with electric power of 750 kVA each, with engine and exhaust gas heat recovery modules. The total heat power of recovery modules makes 1770 kW. The energy complex also includes a double fuel peak boiler system with a heating unit with power of 1000kW, a modular gas control unit, a low-voltage package unit and a standby diesel genset SPARK ENERGY for 500kVA.

All equipment is installed in six weatherproof containers produced at Electrosystems TH facilities in St Petersburg and delivered to the site by rail.

A peculiarity of the heat recovery modules is that they use heat of the engine cooling and exhaust gas systems to produce hot water, and they do not require any other equipment or systems, or additional fuel.

The energy complex is fully automated; the modern control system ensures unattended operation of generating equipment.



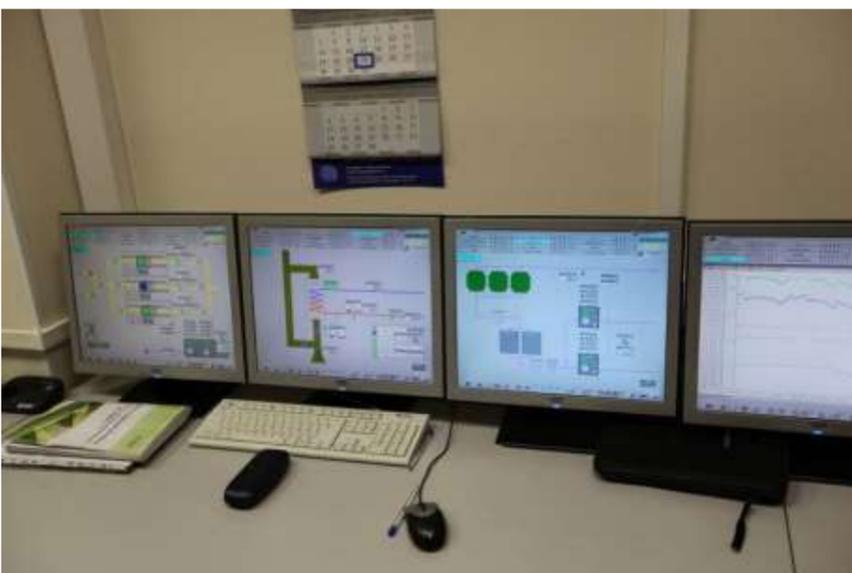
Energy complex, Noginsk



Energy complex was built in 2010 for power and heat supply of tech park in Noginsk. The complex is based on two 16 MW Turbomach turbines.

It includes the peak-load boiler room consisting of two 6 MW boilers. Thermal equipment is operating in co-generation mode.

To provide gas pressure 3 containerized diesel generating sets are installed at the site.





Energy complex for grain terminal, Novorossiysk



limited space and environmental conditions with very high summer temperatures and high humidity.

Highly-efficient power plant is installed directly in the port area. Containerized CHP plants on the basis of 2 MWM gas gensets, type TCG 2020 V20, are of 4 MW total electric power and of 4,19 MW total heat power.

This generating equipment operates in island mode and parallel to the grid without power delivery to the grid. In addition to these gas gensets, diesel genset P220P3 by FG Wilson of 220 kVA is used. .

Modular building for placing auxiliary equipment is a double-deck construction where indoor switchgear, transformer substation for auxiliaries, ballast load modules and heat module are installed. Containers are put in two decks using a rack that is metal structures. Vertical bracing is possible via two metal stairs located symmetrically at front side.

The second construction stage that will increase electric power of Energy complex up to 8 MW is scheduled for 2017.

In 2016 Electrosystems TH together with MWM has worked out the solution for AO "KSK" grain terminal located at Novorossiysk sea port and which is acceptable for the available

Housing Utility Solutions

Mini CHP plant for Terijoki yacht club, Zelenogorsk, Kurortny District



In 2008 Electrosystems TH together with Peterburgteploenergo Ltd. started building a mini CHP plant as part of a program to restructure boiler facilities of Kurortny District of St Petersburg.

In the course of preliminary engineering design we regarded several solutions for the power supply issue. A decisive factor was application of the most environmentally friendly equipment.

As a result it was decided to build a CHP plant on the basis of microturbine units (MTU).

This project is an illustrative example of MTU arrangement opportunities. It was the first time that microturbine units were installed not in a building, but

outdoors, on the power plant roof. This became possible through development of additional systems made by our specialists to provide outdoor operation of the units under temperatures of up to - 40°C.

The plant includes fifteen **microturbine units TA-100RCHP** with single electric power of 100kW operating in parallel for common load; there's an integrated heat recovery system in each unit and two peak boilers with single heat power of 3.5 MW each.

The plant operates in a fully automatic unattended mode. Current performance parameters are transmitted online to the control center located 40km from the plant. Routine maintenance of the microturbines is performed twice a year.

Solutions for shopping and leisure centers, office buildings

A large number of new shopping and leisure centers, office buildings, logistic warehouses, etc. are appearing in big Russian cities nowadays. All these sites refer to power-consuming buildings, and it is often difficult to connect them to centralized city

grid: either connection time is far behind the construction time, or the price of connection is too high. An optimal way out of this situation is to build a standalone power center.

Mini CHP plant for an office center, Moscow



In 2009 specialists of Electrosystems TH implemented a mini CHP plant project for an office complex “City Estate of the late XVIII - early XIX century”,

Moscow. The mini CHP plant is implemented on the basis of ten microturbine units by Capstone with total electric power of 1 MW.

The autonomous power plant operates in the cogeneration mode: exhaust gas energy of the microturbines is used to get heat power for heating of the office premises and the restaurant, and also to provide hot water supply.

The energy complex operates as a main source of electric and heat power. Heat power is generated by means of exhaust gas heat recovery. Ancillary equipment and the switchgear room are located in individual service rooms.



Complex Trigeneration Solutions

Trigeneration is combined production of electricity, heat and cold. Cold is produced by absorption chillers that use heat power, not electric power.

Trigeneration allows for maximally rational use of recovered heat. Moreover, heat application efficiency is high not only in the winter season in case of room heating, but also in summer, when extracted heat is used for air conditioning and other technological

Rus” health resort, Sochi

needs. Year round operation of such unit allows for maximally short payback period.

These systems can be used not only for living premises. They are installed in shopping and leisure centers, offices, hotels and institutions. The units have proved their efficiency in operation for agricultural and large industrial sites.



In 2011 specialists of ElectroSystems Technical Holding started the first stage of the energy complex of “Rus” health resort in Sochi including ten microturbine units by Capstone Turbine Corporation with heat recovery system. A trigeneration system was also implemented as part of the project on the basis of two absorption chillers with total power of 2,8MW.

Application of **microturbine units** is connected with severe environmental requirements, as the power complex is located in the territory of a resort.



Solutions for sports and fitness facilities

Mini CHP plant for a sports and fitness center, Saint-Petersburg



In 2010 Electrosystems TH supplied power equipment for a mini CHP plant of a sports and fitness center.

The mini CHP plant is implemented on the basis of **five microturbine units** by Capstone with heat recovery systems and is designed to provide electricity, heating, ventilation, hot water supply and pool water heating.

Guaranteed and Uninterruptible Power Supply Systems

Guaranteed and uninterruptible power supply for the G8 international press center facilities, Saint- Petersburg



In 2006 the international G8 summit took place in St Petersburg, and as part of the preparations Electrosystems TH supplied a guaranteed and uninterruptible power supply system.

The basis for the guaranteed and uninterruptible power supply system was a double circuit system, the first circuit of which used diesel gensets operating in the standby.

The second circuit used modern static UPSs providing galvanic separation for the most critical consumers of diesel gensets.

The power supply system provided the following:

- full standalone self-sufficiency,
- redundancy of generating capacity,
- redundancy of UPSs connected to critical load, and galvanic separation.

Cash Processing Centre of Headquarters of the Central Bank of the Russian Federation, Saint-Petersburg



The guaranteed power supply complex with power of 2.1 MVA includes four 400 kVA Eaton UPSs which operate in pairs by Parallel Redundancy scheme, and a diesel plant of 2.1 MVA that consists of three parallel diesel gensets by FG Wilson (2x800 kVA and 500 kVA):

- Peripheral systems are based on Eaton interruptible power supply units with power of 250, 130, 65, 18 kVA and a range of UPSs of lower power;
- The complex is one of the largest functional systems of uninterruptible power supply installed on the enterprise premises that is available in the territory of Russia;
- The system of monitoring and remote control has been developed and implemented as part of the complex allowing to control the complex operation and easily regulate any parameters, also under conditions of parallel operation of several diesel gensets. All performance data of engines, alternators and UPSs are processed by a processor and continuously analyzed in the on-line mode;



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