REPUBLICAN
UNITARY
ENTERPRISE

BELNIPIENERGOPROM

IN THE FUTURE WITH NEW DESIGNING TECHNOLOGIES

ESTABLISHED IN 1952

We are glad to present you Belnipienergoprom Republican Unitary Enterprise as a leading company of the Republic of Belarus in the sphere of designing energy sources and heat networks which successfully works with all energy companies in the territory of the Republic of Belarus and in many regions of the Russian Federation. The company has an experience of designing and construction of facilities in such countries as Macedonia (former Yugoslavia), Nigeria, Iran, China, it jointly works out projects with numerous foreign companies.

Highly qualified specialists, availability of modern computers and the widest and continuously increased fund of the normative and technical documentation, the use of sophisticated software make it possible to resolve the whole spectrum of issues of designing the power facilities and to provide modern and high quality development of projects of any complexity. By applying to Belnipienergoprom RUE you will get a high quality solution of your problem.

Director, Candidate of Science

Andrei Nikodimovich Rykov

POLICY OF BELNIPIENERGOPROM RUE IN THE FIELD OF QUALITY

The company sets a mission of producing high quality design estimates as the main criterion of economic stability of the company and the warranty of client's satisfaction.
The company carries out complex design of power facilities and heat networks, development of technical documentation, substantiation of investments and field supervision in relation to prices providing the stable profit for the company and acceptable for consumers by following means:

- preparation of a thematic plan based on requirements of clients and provision of its fulfillment;
- improvement of the designing technology on the basis of the production automation;
- purposeful improvement of skills of specialists of all levels;
- involvement of every employee of the company into the process of design quality assurance;
- assessment of customer satisfaction.

Managers of the company undertake to improve their activity and assume liability for implementation of the Policy in the field of quality.

Director A.N. Rykov

- The company developed and implemented a quality management system in accordance with the requirements of ISO 9001:2008 which was certified by DEKRA Certification Sp.z.o.o in November 2011. Scope of certification includes complex designing of power facilities and heat networks, development of technical documentation and substantiation of investments and field supervision. Structural divisions of the company carry out their activities within the frameworks of the quality management system.

- The company has a certificate of Town Planning and Designing Union non-commercial partnership self-regulatory organization (Moscow, Russian Federation) on the permit for works which influence the safety of capital construction projects.

REPUBLICAN UNITARY ENTERPRISE

BELNIPIENERGOPROM

BELNIPIENERGOPROM RUE, which was established in 1952, is the leading design organization for design of power sources and heat networks of the Ministry of Energy of the Republic of Belarus, it comprises over 650 qualified employees.

The company's functional scheme includes 20 main production and 5 auxiliary divisions, a testing laboratory certified according to STB ISO/IEC 17025 in relation to measurement of emissions from fuel combusting equipment and air emissions.

BELNIPIENERGOPROM RUE RUE has 3 licenses received in the Republic of Belarus, 5 certificates – including quality management system certificate ISO 9001:2008 (DEKRA, Germany).

On September 24, 2009 a certificate (series SP No. 000007) of permit was received for works which influence safety of capital construction objects. The certificate was issued by Town Planning and Designing Union non-commercial partnership self-regulatory organization (the Russian Federation).

I. MAIN BUSINESS ACTIVITIES

- development of substantiations of investments and business-plans;
- development of heat supply circuits for regions, industrial sites and their electronic models;
- technological and construction design of a complex of buildings and structures of new and modernized thermoelectric power plants, boiler houses, main heating systems in territories with engineering and geological conditions of complexity rating I, II and III and seismicity up to 7 grades and over;
- design of production, construction and repair bases of power engineering and industrial objects;
- assessment of impact of power sources and industrial enterprises on environment and execution of ecological passports;
- development, installation and adjustment of industrial control systems of power sources;
- power engineering audit of energy sources and industrial enterprises;
- introduction of highly effective steam and gas technologies for construction and for reconstruction and modernization of the existing power sources;
- design of hydroelectric power plants;
- improvement of heating circuits of the existing energy sources along with application of CCGT plants and gas reciprocating units during their expansion and modernization;
- inventory and development of standards for maximum allowable emission of contaminants;
- use of equipment at the designed power sources operated in local types of fuel, as well as with the use of energy of limit steam and gas flows, wind power plants;
- design of electrical distribution units of power plants and substations, modernization and adjustment of excitation systems of electric generators;
- introduction of voltage control systems at buses 110-330 kV and for own needs of power plants with the aid of transformers OLTC.

For provision of the design process the company possesses a technical library of 9,500 items, the standard and technical documentation fund (GOST, SNiP, STB, SP, TKP, etc.) – 7,000 items, an archive (including electronic one) of typical designs – 20,000 items.

The technical archive contains documentation for 1,800 projects. The TDMS electronic archive makes it possible to store and transfer to the customer design estimates in an electronic form.

II. SUMMARIZED RESULTS

The following facilities have been put into operation as per the designs of **BELNIPIENERGOPROM RUE**:

- 214 turbogenerators having the total capacity 8,157.5 MW;
- 249 boiler units with a total steam-production capacity of 36,040 t/h;
- 118 water heating boilers with a total capacity 19,709 Gcal/h;
- 5 turbo expanding assemblies with a total power of 16.5 MW;
- 780.3 km of main heating circuits;
- 5 hydrogenerators of the Grodno hydropower plant with a total capacity of 17 MW.

Major main heating circuits which link heat sources with heat supply areas of cities have been and are being built in the Republic of Belarus according to the designs of the institute.

PROJECTS IN BELARUS

In Belarus 30 power plants have been built, modernized and reconstructed as per the designs of the institute, including:
- heating TPPs – Minsk TPP-4 (1,035 MW) and Gomel TPP-2 (540 MW);
- industrial heating TPPs – Novopolotsk TPP (505 MW), Mozyr TPP (195 MW), Minsk TPP-3 (420 MW), Mogilev TPP-2 (350 MW), Minsk TPP-5 (730 MW), Grodno TPP-2, Svetlogorsk TPP, Bobruisk TPP and other TPPs of smaller capacity.

The Lukoml GRES 2400 MW and Berioza GRES 1060 MW have been reconstructed and modernized.

All main heating circuits which link heat sources with heat supply areas of cities have been and are being built in the Republic of Belarus as per the designs of the institute.

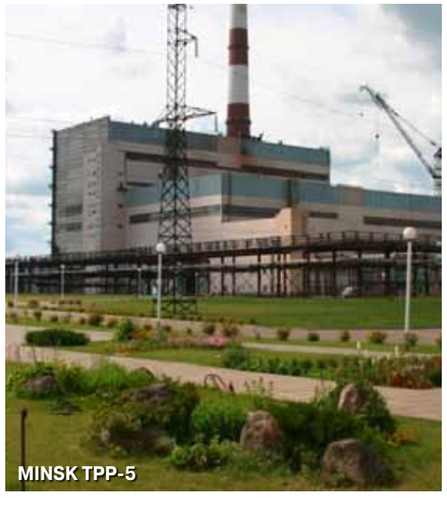

GRODNO TPP


NOVOPOLOTSK TPP


MINSK TPP-3


MOGILEV TPP-2


SVETLOGORSK TPP


MINSK TPP-5


BOBRUISK TPP-2


GOMEL TPP-2


MINSK TPP-4

PROJECTS IN RUSSIA

A number of power engineering projects has been built, modernized and reconstructed as per the designs of **BELNIPIENERGOPROM**: Alexino TPP, Astrakhan GRES, Astrakhan TPP-2, Balakovo TPP-4, TPP of Bryansk Machine Making Plant, Bezymyanskaya TPP of Samara, Volzhsk TPP-1 and TPP-2, Guriev TPP, Kaliningrad GRES-1 and GRES-2, Klintsy TPP, Kursk TPP-1, Michurin TPP, Pervomaisk TPP, Gusev TPP, Dankov TPP, Dorogobuzh TPP, Elets TPP AOOT, Kazan TPP-1, Kaliningrad TPP-2, Penza TPP-1 and TPP-2, Samara GRES, Samara TPP, Saratov GRES, Saratov TPP-1, TPP-2, TPP-5, Smolensk TPP-2, Syzran TPP, Tambov TPP, Tver TPP-2 and TPP-4 (coal), Engels TPP-3, transformer substations “Kudrovo”, “Novo-Bratsevo”, “Ruzaevka”.


SARATOV TPP-5


PENZA TPP


AST RAKHAN TPP


VOLZHSK TPP-2

PROJECTS IN OTHER FOREIGN COUNTRIES

A number of power plants as per the designs of **BELNIPIENERGOPROM** have been built abroad:
- TPP at the Skopje refinery (Yugoslavia),
- TPP-TBS of the Steel Making Plant in Ajaokuta (Nigeria),
- HUANENG TPP in Beijing (PRC)
- Ghorazal TPP (Bangladesh)
- Vilnius TPP-1 (expansion), TPP-2 and TPP-3, a TPP of Ionav Nitrogen Fertilizer Plant, Kaunas TPP, Klaipeda TPP, Petrałyi nai GRES (TPP) (Lithuania).

III. APPLICATION OF ADVANCED CCGT AND GAS RECIPROCATING TECHNOLOGIES DURING DESIGN OF POWER ENGINEERING FACILITIES

Over the last 15 years **BELNIPIENERGOPROM RUE** has successfully mastered the process of designing energy sources with the application of advanced CCGT and gas reciprocating technologies both in new construction and at reconstruction and modernization of the existing power plants.

As a rule, heat recovery schemes of the combined cycle are used for a new construction.

In a number of cases the existing power plants are reconstructed by means of establishment of gas turbine superstructures to the existing steam turbine blocks and steam boilers of TPPs. Being so, combustion products of a gas turbine are discharged into the reconstructed steam generator. Such a scheme has been implemented at three K-160 blocks of the Berioza GRES, at the Kazan and Bezymyank TPPs.

Installation of gas turbines with waste heat boilers which operate with a common steam collector is an especially prospective trend of reconstruction of the existing middle and high pressure TPPs. Such a solution makes it possible to essentially increase electric power generation for heat consumption with relatively small capital expenditures.

APPLICATION OF CCGT AND GAS-TURBINE TECHNOLOGIES

Mozyr Refinery (Belarus)	Dual-purpose gas turbine plant GTU-16 having capacity 16 MW (Mashproject NPO, Ukraine)	Put into operation in 1998
Orsha TPP (Belarus)	CCCP having capacity 66 MW comprising two gas turbines, 27 MW each (Alstom, Switzerland), a waste heat boiler and a steam turbine of 12 MW	Put into operation in 1998
Bezymyansk TPP (Russia)	Dual-purpose gas turbine plant having capacity 25 MW based on NK-37 aircraft engine (SNTK named after Kuznetsov, Russia)	Put into operation in 1999
Kazan TPP (Russia)	Two dual-purpose gas turbine plants having capacity 25 MW based on NK-37 aircraft engine (SNTK named after Kuznetsov, Russia)	Put into operation in 1999
Berioza GRES (Belarus)	Reconstruction of blocks Nos. 3 and 4 (K-150) with superstructure of each one with gas turbines TD-80E having capacity 25 MW (Mashproject NPO, Ukraine)	Put into operation in 2003 and 2005
Grodno-Severnaya Mini-TPP (Belarus)	Installation of a gas turbine with a capacity of 6 MW (MotorSich, Ukraine) with a waste-heat recovery unit	Put into operation in 2006
Dorogobuzh TPP (Russia)	Two cogeneration gas turbine plants having capacity 6 MW each (Saturn NPO, Russia)	Put into operation in 2005
Lida TPP (Belarus)	A gas turbine plant having power 25 MW of NK-37 type (SNTK named after Kuznetsov, Russia) and a waste-heat recovery unit for steam supply to a station collector 3.9 MPa	Put into operation in 2008
Minsk TPP-3 (Belarus)	CCGT plant having capacity 230 MW as a part of GT13E2 gas turbine having power 170 MW (Alstom, Switzerland), a waste-heat recovery unit and a cogeneration steam turbine T-53/67-8.0	Put into operation in 2009
Minsk TPP-2 (Belarus)	Design works were carried out together with CNCOEC for construction of 2 steam and gas blocks comprising a gas turbine SGT-600 having power 25 MW each (Siemens), a waste-heat recovery unit and a heat cogeneration turbine having power 7.5 MW (2*32.5 MW)	Put into operation in 2011
North-Eastern Boiler Plant, Kursk (Russia)	Two gas turbines LM 6000 PD Sprint having power 45.65 MW each (GE Energy) comprising CCGT plant having power 115 MW	Put into operation in 2011
Minsk TPP-5 (Belarus)	Design works were carried out together with CNCOEC for construction of a steam and gas block having power 399 MW comprising a gas turbine having power 280 MW of M701F type (Mitsubishi), a waste-heat recovery unit and a steam turbine with a capacity of 130 MW	Put into operation in 2012

Centralnaya boiler plant, Astrakhan (Russia)	Installation of two two-boiler single-turbine units having electrical power 115 and 120 MW and total heat capacity 130 Gcal/h comprising: four gas turbines LM6000 PF DF Sprint (45.65 MW, General Electric), four waste-heat steam boilers KGT-44/4.6-435-13/0.5-210 and two steam turbines T-17/23-4.5/0.18	Put into operation in 2013
Grodno TPP-2 (Belarus)	A gas turbine plant having power 121.6 MW (General Electric, India) with a waste-heat steam boiler for steam discharge to a general station collector 14 MPA to the existing steam turbines	Put into operation in 2013
Berioza GRES (Belarus)	Reconstruction of block No. 5 (K-160) by superstructuring two gas turbines SGT-700 having power 30 MW each (Siemens)	Put into operation in 2014
Lukoml GRES (Belarus)	Design works were carried out together with CMEC for construction of a steam and gas block having power 426 MW comprising a gas turbine having power 280 MW of SGT-5-4000F (Siemens), a waste-heat recovery unit and a steam turbine of 130 MW	Put into operation in 2014
Berioza GRES (Belarus)	Design works were carried out together with Chinese Machinery Engineering Corporation (CMEC) for construction of a steam and gas block having power 426 MW comprising a gas turbine having power 280 MW of SGT-5-4000F (Siemens), a waste-heat recovery unit and a steam turbine of 130 MW	Put into operation in 2014
Stavrolen JSC, Budenovsk (Russia)	Installation of a steam and gas block having electrical power 135 MW, heating capacity 58 Gcal/h comprising two gas turbines having power 58.9 MW of Tren60 type (Rolls-Royse), two waste heat boilers and a steam turbine T-18-4.2/0.25 having power 18 MW	At the implementation stage
Voronezh TPP-1 (Russia)	Installation of a two-boiler steam and gas turbine unit having electrical power 223 MW, heating capacity 130 Gcal/h comprising: four gas turbines LM6000 PF DF Sprint (General Electric), four waste-heat steam boilers and two steam turbines T-25/34-3.4/0.12	At the implementation stage
Huadian-Tenin TPP, Yaroslavl (Russia)	Installation of a two-boiler 450 MW, comprising two gas turbine plants GTU-160 (Silovye mashiny JSC, Russia), two waste-heat recovery units Pr-225/4-7, 60/0.89-510/217 (ZIOMAR Engineering Company, Russia) and a steam-turbine plant of LN-150-7.6/0.84 (Harbin Turbine Making Plant, China)	At the implementation stage
Mogilev TPP-1 (Belarus)	In 2011 an architectural design was fulfilled which stipulated installation of a gas turbine having electrical power 25 MW (an analogue – SGT-600 of Siemens), a waste-heat recovery unit without burning up devices (an analogue – KGT-40-3.9-440 made by Barnaul Boiler Plant NPO) and replacement of two steam turbines Nos. 3 and 4 with counter-pressure 0.35-0.45 MPa for two steam turbines with a capacity 6 MW each with counter-pressure 0.07-0.25 MPa	At the implementation stage
Gomel TPP-1 (Belarus)	In 2013 an architectural design was fulfilled for construction of a steam and gas plant of 35 MW with the use of the existing steam turbo generator R-6-3.4/0.5-1 having electrical power 6 MW and installation of a new steam turbo generator (an analogue – Siemens SST-060/060 Tandem) for operation on exhaust steam 0.6 MPa of the existing turbo generator, as well as a gas turbine plant with a capacity of 25 MW (an analogue - SGT-600 Siemens) and a waste-heat recovery unit (complete shipment with a gas turbine) having nominal steam capacity 40 t/h and fresh steam parameters 3.9 MPa/440oC. Besides, two steam turbines Nos. 3, 4 with counter pressure 0.35-0.45 MPa are expected to be replaced for two steam turbines having power 6 MW each with counter-pressure 0.07-0.25 MPa.	At the implementation stage

ORSHA TPP (BELARUS)

A CCCP having power 66 MW comprising two gas turbines of 27 MW (Alstom, Switzerland), a waste-heat recovery unit and a steam turbine 12 MW.
Put into operation in 1998.

KAZAN TPP-1 (RUSSIA)

Two cogeneration gas turbine plants having power 25 MW, each based on NK-37 engine (SNTK named after Kuznetsov, Russia).
Put into operation in 2005

LIDA TPP (BELARUS)

A gas turbine plant having power 25 MW of NK-37 type (SNTK named after Kuznetsov, Russia) and a waste-heat recovery unit for steam supply to a station collector 3.9 MPa.
Put into operation in 2008.

BERIOZA GRES (BELARUS)

Reconstruction of blocks Nos. 3 and 4 (K-150) with a superstructure of two gas turbines TD-80E having power 25 MW (Mashproject NPO, Ukraine).
Put into operation in 2003 and 2005.

NORTH-WESTERN BOILER PLANT OF KURSK (RUSSIA)

Two gas turbines LM 6000 PD Sprint having power 45.65 MW each (GE Energy) comprising CCGT plant having power 115 MW. Put into operation in 2011.

MINSK TPP-3 (BELARUS)

A CCGT plant having capacity 230 MW comprising a GT13E2 gas turbine with a capacity of 170 MW (Alstom, Switzerland), a waste-heat recovery unit and a cogeneration steam turbine T-53/67-8.0
Put into operation in 2009.

MINSK TPP-5

Block No. 2 having power 400 MW, comprising a gas turbine plant having power 280 MW, a waste-heat recovery unit with a capacity of 130 MW.

CENTRALNAYA BOILER PLANT, ASTRAKHAN (RUSSIA)
Installation of two-boiler four-turbine unit LM6000 PF DF Sprint.
Electrical power – 235 MW.
Heating capacity – 130 Gcal/h.
Put into operation in 2013.

MINSK TPP-2 (BELARUS)
2 steam and gas blocks, comprising a gas turbine SGT-600 having power 25 MW each (Siemens), a waste-heat recovery unit and a cogeneration turbine having power 7.5 MW.
Put into operation in 2011.

IV. EXPERIENCE IN DESIGNS WITH THE USE OF EQUIPMENT FOR BIOFUEL BURNING

Since 2003 **BELNIPIENERGOPROM RUE** has been designing power projects by using the local types of fuel - timber, lignin, peat and peat bricks within the frameworks of the state program of power sources construction.

Equipment of Belarusian, Russian and European manufacturers has been used while constructing as per the abovementioned designs.

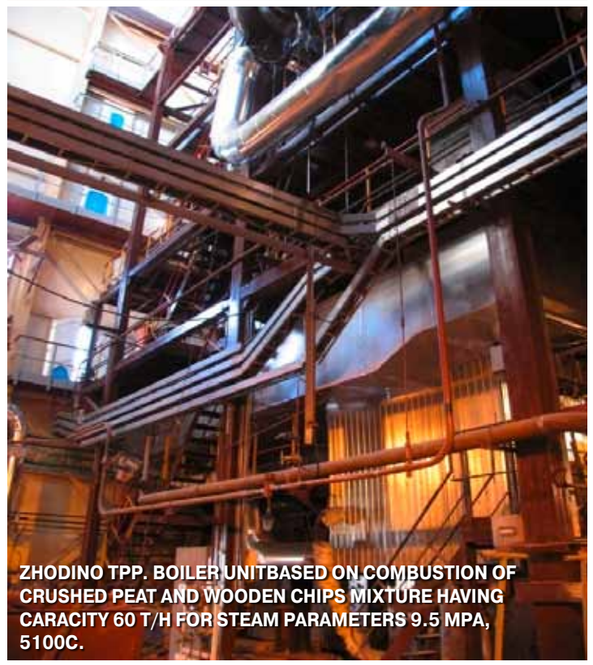
DESIGNS WITH THE USE OF EQUIPMENT OPERATED ON FUEL-WOOD, PEAT AND LIGNIN

PROJECT DESCRIPTION	YEAR OF PUTTING INTO OPERATION	TURBO GENERATORS		STEAM BOILERS				
		QUANTITY AND TYPE	POWER, MW	QUANTITY AND TYPE	FUEL	COMBUSTION METHOD	CAPACITY, T/H	STEAM PARAMETERS, MPA/S
Boiler plant in Osipovichi	2005	1*t/u PTG-1.2-0.4-2.4/0.12	1,2	2*KE-10-2.4-300 OGMV Bijsk Boiler Plant	Fire-wood, peat	Swirling-type furnace	10	2,4/300
Bobruisk TPP-1				1*b/u KE-30 INECO	Lignin, peat	Fluidized bed	30	3,9/440
BelGRES	2006	1*t/u PTG-1.2-0.4-2.4/0.12	1,2	1*KE 20-24	Fire-wood	Fluidized bed	20	2,4/350
Boiler plant in Vileika		1*t/u P-2.4-2.3/0.12	2,4	1*KE-25-2,4-350	Fire-wood	Fluidized bed	25	2,4/350
Pinsk TPP	2007	1*t/u PTG-4.0-10.5P-0.6/0.1	4,0	2*E 10-3.9-440T Bijsk Boiler Plant	Fire-wood	Swirling-type furnace	10	3,9/440
Zhodino TPP	2009			1*E-60-9.5-510 INECO	Peat bricks, fire-wood	Fluidized bed	60	9,5/510
BelGRES	2012			1*E-30-3.9-440DF Beloozersk Power mechanical plant	Fire-wood	Fluidized bed	30	3,9/440
Boiler plant in Baran (at the stage of construction)	2013		3,25	Thermal oil boiler Polytechnik Luft- und Fereuerungs Technik GmbH (Austria), heating capacity 14.79 Gcal/h	Milled peat, chip fuel	ORC module		
Boiler plant in Luninets (at the stage of construction)	Design of 2012	1*t/u P-4.3-3.9/0.49-0.12	4,0	E-20-3.9-440DF E-20-3.9-440DF Beloozersk Power mechanical plant JSC and NPO CKTI JSC	Milled peat, fuel chips	Fluidized bed	20 10	3,9/440
Mozyr TPP	Design of 2013			The design stipulates installation of a steam boiler having capacity 200 t/h	Peat bricks	Fluidized bed	200	14,0/550

DESIGNS OF POWER SOURCES OPERATED ON LOCAL FUELS

PINSK TPP

OSIPOVICHI MINI-TPP



ZHODINO TPP. BOILER UNITBASED ON COMBUSTION OF CRUSHED PEAT AND WOODEN CHIPS MIXTURE HAVING CARACITY 60 T/H FOR STEAM PARAMETERS 9.5 MPA, 5100C.

ZHODINO TPP
BOILER UNIT BUILDING

V. DESIGING HYDRO POWER PLANTS

With the aim of improving the energy security of the Republic of Belarus works were carried out for selection of power sites on biggest rivers – Western Dvina, Dnieper and Neman.

Taking into account the plain character of the territory of Belarus and the existing water pressures construction of two hydro power plants is recommended on the river Neman with a total capacity 38 MW, as well as four – on the Western Dvina (120 MW) and four – on the Dnieper (20 MW).

In accordance with the design of **BELNIPIENERGOPROM RUE** in June 2012 the Grodno Hydro Power Plant having power 17 MW was put into operation.

The following projects for construction of hydro power plants on the Western Dvina are at the stage of implementation:
- Polotsk hydro power plant – 22 MW, general contractor – Technopromexport CJSC (Russia),
- Vitebsk hydro power plant – 40 MW, general contractor – CNEC, China.

GRODNO HPP ON NEMAN-RIVER PUT INTO OPERATION IN 2012

Electric power.....5 electric generators of the total capacity 17 MW
Annual electric power output.....85 mln. kWh
River width.....120-150 m
Pressure .....7.3 m
Average long-term water discharge at the river station.....199 m3/s

POLOTSK HPP

Electric power.....20 MW
5 shaft hydraulic units.....4.75 MW
Annual electric power output.....111 mln. kWh
River width.....100-150 m

Average pressure.....7.7 m
Average water discharge.....292 m3/s
Dam maximum water discharge.....3750 m3/s

ВИТЕБСКАЯ ГЭС

Electric power.....40 MW
4 capsule hydraulic units.....10.3 MW each
Annual electric power output.....138 mln. kWh
River width.....80-120 m

Average pressure.....9.1 m
Average water discharge.....213 m3/s
Dam maximum water discharge.....2710 m3/s

VI. APPLICATION OF TURBO EXPANDING ASSEMBLIES

Designing of power engineering projects with the use of potential energy of compressed gas has become a new direction in the activity of the institute. The use of natural gas pressure drop, which was previously lost in reducing stations, for electric power generation in a turbo expanding assembly improves efficiency of power source operation.

Units of this type which were made as per the designs of the institute were implemented:
- at Lukoml GRES (5 MW and 2.5 MW in 2004 and 2006);
- at Minsk TPP-4 (two units 2.5 MW each in 2005 and 2006);
- at Gomel TPP-2 (4 MW in 2008).

APPLICATION OF TURBO EXPANDING ASSEMBLIES IN DESIGNS

TURBO-EXPANDER UNIT 4 MW OF GOMEL TPP-2

TURBO-EXPANDER UNIT 4 MW OF MINSK TPP-4

TURBO-EXPANDER UNIT GENERATOR 5 MW OF LUKOMOL GRES

VII. DEVELOPMENT OF AUTOMATED PROCESS CONTROL SYSTEMS

BELNIPIENERGOPROM RUE carries out complex works on designing, installation and adjustment of process control systems at power engineering facilities. The industrial control systems worked out by **BELNIPIENERGOPROM RUE** were introduced at Minsk TPP-4 (steam generator units No.3 and No. 6), Vitebsk TPP (turbo generators No. 3 and No. 2), Grodno TPP No. 2 (steam generator unit No.3), Bobruisk TPP-2 (steam generator unit No.1), Bobruisk TPP-1 (turbo generator No. 2), Gomel TPP-1 (steam generator unit No.2, turbo generator P-12), Vileika mini-TPP of Molodechno electric supply networks, mini-TPP of Soligorsk electric supply networks, RK-3 of Molodechno electric supply networks in Vileika, in Mogilev and Grodno heat networks.

In order to resolve the task of complex voltage regulation in the energy system of the Republic of Belarus specialists of **BELNIPIENERGOPROM RUE** have worked out and implemented in industry a number of voltage control systems, which include:

1. Introduction of Belarusian excitation systems for modernization of:
- cross-field exciters for generators having power up to 63 MW (Brest TPP);
- nonbrush field excitation systems for generators having power up to 30 MW (Bobruisk TPP-1);
- thyristor excitation systems for generators having power up to 12 MW (Gomel TPP-1).

2. Designing and implementation of group voltage control systems at bus bars of the electric power station (110 kV...330 kV), at bus bars for own needs (6 kV...10 kV); (Gomel TPP-2, Lukoml GRES, Berioza GRES)
Besides, the multifunctional system provides:
- self-running, emergency registration;
- control of parameters of connections (active and reactive power, currents, positive, negative, zero sequence voltage, coefficient of margin reserve);
- diagnostics of a switching device for on-load tap changing, motors of mechanisms for auxiliaries, power switches.

3. Designing and implementation of voltage control systems at substations 110 kV...330 kV.
Fulfilled in Gomel electric networks Gomelcable with control of load parameters, feeder determination with earth short circuit.
The system does not require installation of earthing resistors, zero-sequence transformers. The system is highly sensitive which makes it possible to find a damaged feeder with the total capacitive current up to 3A.

4. Designing and implementation of voltage control systems based on a variable speed drive (Minsk TPP-4, Gomel TPP-2) along with the use of a mathematical model of a variable speed drive, a pump making it possible to precisely determine technical and economical indicators, optimal composition and parameters of equipment. Also, the system allows to optimally distribute loads between parallel-working mechanisms allowing to save additionally up to 10% of energy.

5. Development of a microprocessor continuous diagnostic system for current transformers having voltage 110-1150 kV (TT) (Gomel power station, Gomselmash, Gomel-330).The system carries out: automated measurement of dielectric dissipation factor, capacitance and current of complex conductance of the main insulation with the required precision, control and determination of the full resistance and power of secondary load for protection and measurements, continuous information supply to the operator's station by wireless channels

with fault warning function.

One of the main advantages of this system, as compared with the formerly used ones, includes the use of the technology of measurement of leakage currents and load of current transformers without break of an earthing ring and secondary current circuits, what essentially improves reliability and safety of main equipment operation.

6. The design of optimization of distributing network 6-10 kV operation with the insulated neutral is at the stage of implementation (introduction) (Gomel power station, Southern-1, Southern-2, Novobelitsa).

Main features:

- selection of the optimal method of neutral grounding (combined, compensated, resistive);
- limitation of voltages overload at arc short circuits and single-phase ground shortings;
- registration of circuit mode parameters in stationary and emergency modes;
- determination of a section where earth short circuit occurred on a real time basis;
- the method of determination of the section of arc short circuits and single-phase ground shortings does not require installation of resistors or other components in the circuit neutral;
- information about the operation mode of remote sections of transformer/distribution substations is sent to the upper level through the Ethernet networks by means of a GRPS modem;
- the system for determination of arc short circuits and single-phase ground shortings is intended for operation in both cable and mixed networks;
- the system includes a network monitoring device along with registration of voltage overloads and other parameters of the network at arc short circuits and single-phase ground shortings.

VIII. DESIGNING OF HEAT SUPPLY NETWORKS AND MAIN HEAT NETWORKS

DISTRICT HEATING SYSTEM OF MINSK TPP-4

In 1974 implementation of the heat supply system was started for Minsk with the population exceeding 1 million people on the basis of a suburban TPP (in present, TPP-4). The design provided for the use of the existing municipal boiler plants for operation in the peaking operation mode in a complex with Minsk TPP-4, the use of the increased schedule of network water temperature (180-70oC) in transit pipelines having diameter 1200 and 1400 mm. The estimated heat release from the TPP and boiler plants is equal to 2000Gcal/h.

In 1983 the staff of **BELNIPIENERGOPROM RUE** was awarded by the Council of Ministers of the USSR “For designing and construction of district heating systems in Minsk”.

Presently, the complex includes Minsk TPP-4 (1035 MW, 1519 Gcal/h), five peak boiler plants:

- Kharkov (310 Gcal/h),
- Western (190 Gcal/h),
- Orel (195 Gcal/h),
- Kurasovshchina (225 Gcal/h),
- Masyukovshchina (245 Gcal/h)

and 62.2 km of heating networks having diameter 1400 – 800 mm.

DISTRICT HEATING SYSTEM OF GOMEL TPP-2

In 1980-1982 the district heating system of Gomel TPP-2 was worked out in cooperation with peaking boiler plants “Western” and “Northern”. Heat supply of ZLIN and apartment blocks of Selmash region is provided for through the distributing main line 2Du 1000 mm, length – 10 km with installation of peaking water heating boilers KVGM-180 at TPP-2. Transit main lines to peaking boiler plant “Western” having length 9.5 km and peaking boiler plant “Northern” having length 16 km 2Du, 1000 mm each (heat release 300 Gcal/h).The heat supply area of TPP-2 is equal to 900 Gcal/h.

HEAT SUPPLY OF AREA BEHIND THE NEMAN RIVER OF GRODNO

For reliable heat supply of the area behind the Neman river in conditions of heat consumption growth due to residential construction and withdrawal of small boiler plants main line M-14 Du700 mm was designed and built along with installation of pipelines through the Neman river as a part of the existing “Rumliovsky” bridge. Heating line 2Du500 mm (with a booster pump station) which loops M-4 and M-14 is in its final stage of construction. The construction of the third main line to the area behind the Neman river due to growth of heat consumption of the Southern district (up to 100-120 Gcal/h) is planned.

HEAT SUPPLY OF RIGHT-BANK PART OF MOGILEV

In 2009-2010 a big project was implemented for thermal energy supply from Mogilev TPP-2 to the right-bank part of the city (to the heat supply area of boiler plant RK-1) with transition through Dnieper-river “The main heat network from pavilion No.2 by Gomel highway to boiler plant No. 1 in 44, Kaluzhskaya st., in Mogilev”. A unique double-contoured heat supply circuit was established from MTPP-2, including construction of 14.24 km of heat line 2Du700, 2Du600 (the first contour) and four booster pump stations with plate water-to-water heat exchangers at branches of the second contour. Technical solutions were worked out in the design, when allowed the maximum use of determined cogeneration power of the main equipment of Mogilev TPP-2 - as the result loading of turbine extractions and CHP electricity production increased making it possible to save about 40,000 tons of conventional fuel per annum.

Transfer of boiler plant RK-1 to the peaking operation mode is envisaged. The design stipulates technical possibility of heat supply to the area of Vitebsky avenue, Dimitrov avenue, Gomel highway from RK-1. An automated process control system was established for remote control of pumps and disconnecting valves of pump stations and pavilions from dispatch control board on the basis of Zadneprovsky District of Heat Networks.

HEAT SUPPLY OF SOUTHERN PART OF KALININGRAD

In 2009 Belnipienergoprom RUE worked out a design “Construction of a heat main line from Kaliningrad TPP-2 to the Southern part of Kaliningrad” with heat supply from Kaliningrad TPP-2 to the southern part of Kaliningrad in the amount of 297 Gcal/h.

The design provides for:

- construction of the primary cooling circuit heating line 1 Dup800 mm+Duo700 mm, length 9.3 km in the overhead execution, including punctures of automobile roads and construction of metal girders for passages via railway lines at the section from Kaliningrad TPP-2 to the heat pump station;
- construction of pipelines sections of the secondary coolant circuit with a diameter Du700 mm from the heat pump station to points of connection to heat networks of the city having length 2.0 km;
- construction of the heat pump station, including external power supply cable laying from “Southern” substation and “Molokozavodskaya” substation having length 7.0 km.

The design was implemented on October 21, 2010, when the first stage of the heat line from Kaliningrad TPP-2 was commissioned. Construction of the heat line is the biggest project in relation to the volume of investments in the Kaliningrad thermal power engineering during the recent years and the first branch project “Kaliningrad TPP-2 JSC “INTER RAO EEC” in the sphere of development of heating networks of the region.

IX. OPTIMIZATION OF HEAT SUPPLY OF CITIES AND INDUSTRIAL UNITS

BELNIPIENERGOPROM RUE is the head company in the Republic of Belarus for development of heat supply systems of the cities, where energy sources of the Ministry of Energy are located. Besides, **BELNIPIENERGOPROM RUE** has developed heat supply systems for a number of Russian cities:

SARATOV	ASTRAKHAN	TOLIATTI	ARMAVIR
SAMARA	NOVOROSSIYSK	BRYANSK	LIPETSK
NOVOKUIBYSHEVSK	KISLOVODSK	KALUGA	ELETS
NOVOMOSCOVSK	SOCHI	DANKOV	VOLZHSK
NOGINSK	KALININGRAD	BALAKOVO	ENGELS
TVER	PENZA	KURSK	

Constant change of places of location, volumes and terms of construction of new residential areas and public objects by local authorities resulted in increased periods and volumes of work it was decided to transfer to electronic simulation of heat supply systems.

For these purposes electronic simulation of heat supply systems was introduced with the use of the informational and graphical systems CityCom-TeploGraf, Zulu.

To the present time electronic models of heat supply networks have been worked out for Minsk, Gomel, Borisov, Kursk, Smolensk, Kaliningrad, Nyagan and Kogalym of Khanty-Mansi Autonomous Okrug.

X. DESIGNING OF BELARUSIAN NUCLEAR POWER PLANT

Due to taking the decision on construction of a nuclear power plant in the Republic of Belarus **BELNIPIENERGOPROM RUE** has fulfilled works on:

- selection of a site for NPP construction;
- substantiation of investments for the project “Belarusian Nuclear Power Plant”;
- assessment of impact on the environment;
- design estimates for construction of a complex of buildings and structures (production base) linked with the technology of construction of the nuclear power plant.

The site of industrial base includes the following facilities:

- administration and amenity block;
- a complex of production buildings and premises, including amenity premises for employees of the complex;

- concrete mortar facilities having capacity 180 m3/h;
- a station for unloading the aggregates from railway carriages, amenity premises;
- storage facilities;
- storage facilities of the general contractor (heated and unheated warehouses, sites for storage of materials and structures);
- repair shops of the general contractor, as well as complexes of buildings and structures by types of fulfilled works;
- general construction facilities (a transformer substation, a boiler room, check points).

FIRE STATION OF BELARUSIAN NPP

The fire station of the Belarusian NPP has been designed for 12 vehicles comprising: a fire station, warehouses, a protective construction.

With the purpose of creating an effective NPP rescue department as a part of a fire station the rescue equipment, processing equipment, survival gear, public address and general alarm equipment, informational and computing equipment, furniture and inventory.

The designed fire station secures full readiness for solution of practical tasks related to the Belarusian NPP facing the ESF&H Emergency Response Division of the Republic of Belarus.

XI. TECHNICAL EQUIPMENT

For implementation of the design process the company possesses: over 650 highly qualified employees, including 11 candidates of sciences, 469 employees with higher education, over 670 modern computers, 630 of them are united to a local computing network, modern software:

- AutoCAD 2009
- program for developing construction design and estimate documentation GraphiCS 4.0
- Ecolog unified program for calculation of atmosphere pollution
- program for assessment of noise emission due to external impacts on the basis of Ecologist-Noise software (Standard option)
- program for calculating and designing thermal insulation of pipelines “Insulation”
- program for selection of diameters and hydraulic calculation of pipeline systems “Hydraulic system”
- program of strength calculation of pipelines “START” + “START-Soil”
- compatibility module “START – open format”
- program of thermal and hydraulic calculation of branched pipeline “FLOW 1F”
- program complex for calculation of sanitary systems “ARS-PS”
- program for calculation of flow meters for measurement of consumption of gases and liquids “ISO Flow meter”
- module for consumption calculation with the aid of special constriction devise as per RD 50-411-83 “ISO Flow meter”
- program for designing single footings for frame buildings “FOK PK-2006”
- software package for calculation of strength and designing of civil structures “Scad Office 11.3”
- software package for fulfillment of electrical technical calculations during designing of electrical power systems “EnergyCS”
- program for lighting technical calculations during designing of lighting systems “ElectriCS Light”
- software package “CREDO III” for procession of engineering surveys:
  - “Transform 3.0”,
  - “Converter 1.0”,
  - “General layout 1.0”,
  - “CREDO-Dorogi”

- program for designing steel structures “Real STEEL”
- program for professional designing of video monitoring systems “VideoCAD”
- engineering and construction reference book “SpIn” 2.2
- estimate software with costing standards database 2001 of Kursk province “A0”
- software package for calculation of estimates “Grand-Estimates”, 5.5.2
- program complex of the integrated system of estimated and resource calculations “CIC-2012”
- system for estimated and resource calculations in construction “ABC-4PC”
- library informational system “IRBIS-32”
- software program for transfer of the paper archive to the electronic form and subsequent editing “RasterID”
- editing program for operation with raster and vector graphics “Spotlight”
- software package “FactorySuite” for designing of informational real-time systems. Programming environment “Wonderware Development Studio”
- software package of finite element calculations of geotechnical objects “Plaxis 2D v9”
- informational computing system “CityCom-TeploGraf” as a part of sub-systems:
  - “Heat losses”
  - “Cost of heat supplies”
- software of automation of settlements “MatCAD 14”
- software package of three-dimensional designing “AVEVA PDMS 12”
- computer-aided design system for intercircuit wiring “SAPR TsVK”
- software package FOR COST ESTIMATE CALCULATION “GosStrojSmeta” 2.0
- software program of simulation and analysis of transient processes in multi-phase transmission systems, “EMTP-RW”
- analysis package for heat supply systems “Zulu”

THE FOLLOWING FACILITIES WERE CONSTRUCTED AS PER THE DESIGNS OF THE INSTITUTE

48 TPPS OF VARIOUS CAPACITY,
A NUMBER OF THE EXISTING TPPS WAS MODERNIZED,
154 TURBO GENERATORS WITH THE TOTAL CAPACITY OF OVER 6,993 MW,
210 POWER-GENERATING BOILERS AND
140 HOT WATER BOILERS AND ABOUT
712 KM OF TRANSMISSION HEAT NETWORKS HAVE BEEN PUT INTO OPERATION.

FOREIGN FACILITIES:

- TPP of refinery in Skopje, Yugoslavia.
- TPP-TBS of steel making plant in Ajaokuta, Nigeria.
- Electric power plants in China, Iran, Bangladesh, Libya were built as per the designs of Belnipienergoprom RUE.

LITHUANIA:

- Vilnius TPP-1 (expansion)
- Vilnius TPP-2
- Vilnius TPP-3
- TPP of Ionav Nitrogen Fertilizer Plant
- Kaunas TPP
- Klaipeda TPP
- Petrašiūnai GRES (TPP)
- Mini-TPP in Panevėžys
- 12 km of transmission heat networks were commissioned

THE FOLLOWING FACILITIES HAVE BEEN BUILT, RECONSTRUCTED, MODERNIZED IN RUSSIA AS PER OUR DESIGNS:

- Alexino TPP
- Astrakhan GRES
- Astrakhan TPP-2 and TPP-3
- Balakovo TPP-4
- TPP of Bryansk Machine Making Plant
- Bezymyansk TPP of Samara
- Volzhsk TPP-1 and TPP-2
- Guriev TPP
- Gusev TPP
- Dankov TPP
- Dorogobuzh TPP
- Elets TPP AOOT
- Kazan TPP-1
- Kaliningrad GRES-1
- Kaliningrad GRES-2 (reconstruction)
- Kaliningrad TPP-2
- Klintsy TPP
- Kursk TPP-1
- Michurin TPP
- Pervomaisk TPP
- Penza TPP-1 and TPP-2
- Samara GRES
- Samara TPP
- Saratov GRES
- Saratov TPP-1, TPP-2, TPP-5
- Smolensk TPP-2
- Syzran TPP
- Tambov TPP
- Tver TPP-3 and TPP-4
- Engels TPP-3
- CCGT plant 115 of North-Western boiler plant in Kursk


LUKOML GRES


SVETLOGORSK TPP


MINSK TPP-4


Orsha TPP


Grodno TPP-2

Minsk TPP-5

Mogilev TPP-2


North-Western boiler plant in Kursk


Витебская ТЭЦ


Gomel TPP-2


Osipovichi TPP

THE FOLLOWING FACILITIES HAVE BEEN BUILT, RECONSTRUCTED, MODERNIZED IN BELARUS AS PER OUR DESIGNS:

- BelGRES
- Lukoml GRES
- Berioza GRES
- Minsk TPP-2
- Minsk TPP-3
- Minsk TPP-4
- Minsk TPP-5
- Orsha TPP
- Mozyr TPP
- Novopolotsk TPP
- Polotsk TPP-1
- Pinsk TPP-1
- Bobruisk TPP-1
- Bobruisk TPP-2
- Lida TPP
- Brest TPP
- Baranovichi TPP
- Vitebsk TPP
- Svetlogorsk TPP
- Gomel TPP-2
- Zhodino TPP
- Grodno TPP-2
- Mogilev TPP-1
- Mogilev TPP-2

Turbo-generator and gas turbine plants at:

- Mozyr Refinery
- Naphtan Production Association

BACKGROUND

The Minsk Division of the All-Union Designing Institute PROMENERGOPROJECT was established in 1952 on the basis of the designing office of Belenergoprojectstroi Trust. The Division was entrusted with the task of development of designs for thermal power plants for Byelorussian, Lithuanian SSR and a number of provinces of the Russian Federation (Smolensk, Kalinin, Bryansk, Kuibyshev, Saratov, etc.). During the initial period the Division designed small capacity TPPs of the middle pressure with turbines having power 1.5-12 MW.

In 1974 the Minsk Division of PROMENERGOPROJECT Institute was transformed to the Belarusian Division of VNIPIenergoprom.

Starting from 38 employees in 1952 in the 80-ies the Belarusian Division by strength and creative potential became the leading one in the system of VNIPIenergoprom. The number of employees in the department exceeded 1000 persons, included 160 persons who worked in research departments. It should be noted that research and design works of the institute ensured:

- creation of unique district heating systems in a number of cities of Russia and Belarus, including the city of Minsk, the group of creators were awarded by the Council of Ministers in 1983;
- beginning of application of the heat supply systems with nuclear sources, including substantiation and initiating of construction of the Minsk NTPP;
- taking the technical and schematic decisions for attraction of TPPs to regulation of night failures of the schedule of electric loads of power systems firstly implemented at BTGs of Minsk TPP-4 and Gomel TPP-2;
- along with the E. O. Paton Electric Welding Institute (Ukraine) development of highly efficient self-compensated pipelines and their application in transmission heat networks (Minsk, Vitebsk, St. Petersburg, Kiev);
- revival and development of cogeneration-based district heating of small capacity;
- establishment of new standards for harmful gaseous emissions connected with power engineering, etc.

During substantiation and construction of TPPs the most comprehensive equipment was used and progressive technical and technological decisions were taken. At Belarusian TPPs the following types of equipment were firstly installed:

- cogeneration turbine T-100-130 at Minsk TPP-3 (1962);
- cogeneration turbine PT-135-130 at Mozyr TPP (1975);
- boiler with a steam capacity of 420 t/h BKZ-420 NGM at Bobruisk TPP-2.

During TPPs construction the serial design of gas-and-oil-burning TPP of increased operational activity was worked out with the participation of VNIPIENERGOPROM BO, which was widely used in the USSR. Its authors were awarded by the Council of Ministers of the USSR in 1981.

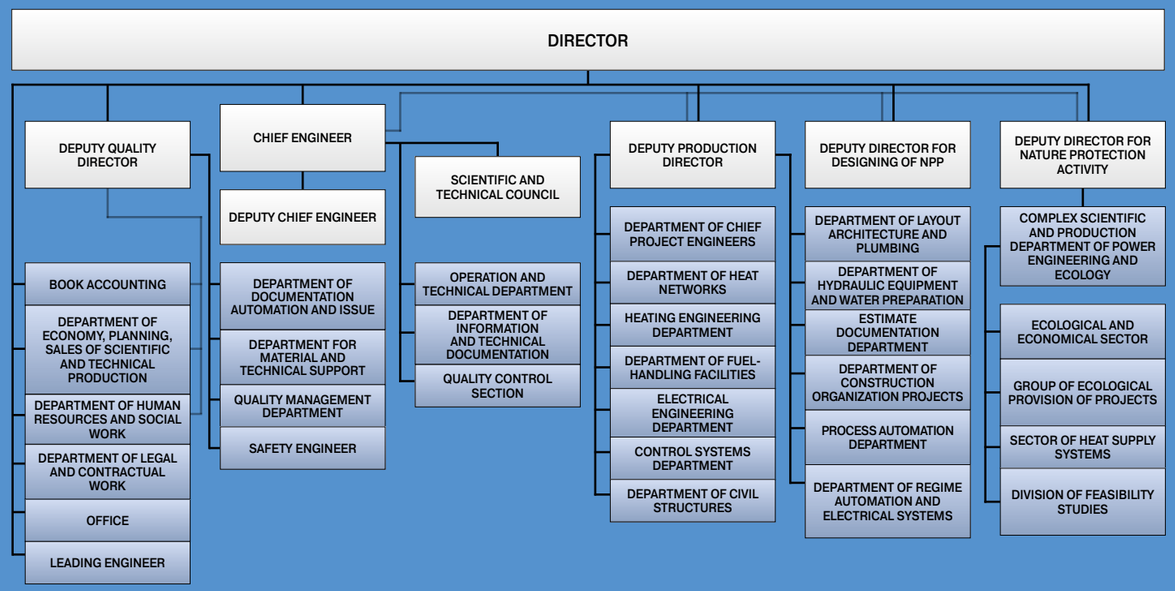
MOST IMPORTANT ACHIEVEMENTS IN THE 80-IES AND IN THE EARLY 90-IES INCLUDE THE FOLLOWING FACILITIES CONSTRUCTED AND PUT INTO OPERATION AS PER THE DESIGNS OF **BELNIPIENERGOPROM RUE**:

- three cogeneration energy units having capacity 250 MW each at Minsk TPP-4 (1985, 1987 and 1998);
- two energy units having capacity 110 MW each at Astrakhan TPP-2 (1986 and 1987);
- three cogeneration energy units having capacity 180 MW each at Gomel TPP-2 (1986, 1988 and 1995);
- a condensation and cogeneration unit having capacity 330 MW each at Minsk TPP-5 (1999).

In 1992 the Belarusian division was transformed to Belnipienergoprom Belarusian Research and Design Institute (in 1996 it was renamed to BELNIPIENERGOPROM State Enterprise, in 2000 it was renamed to Belnipienergoprom Republican Unitary Enterprise).

Presently, Belnipienergoprom RUE is a big specialized company for designing of power sources having more than 600 engineers, technicians and scientists. It successfully operates with all power engineering associations and enterprises in the territory of the Republic of Belarus and in a number of regions of the Russian Federation. The company is maintaining business contacts and broadening cooperatoin with foreign design companies (Energoproject, Poland; Energoproject, Ukraine; NCPI and CSEPDI, China; Ukrhydroproject, Ukraine; Technopromexport, the Russian Federation), manufacturers and suppliers of power equipment both in CIS countries and in foreign states (ABB, SIEMENS; GEC ALSTHOM; AREVA; power plants of the Russian Federation and Ukraine).

ORGANIZATIONAL STRUCTURE OF BEBLNIPIENERGOPROM RUE MANAGEMENT



INFORMATION FOR PARTNERS

DIRECTOR .....CANDIDATE OF SCIENCES ANDREI N. RYKOV

CHIEF ENGINEER.....SERGEI V. PERTSEV

DEPUTY PRODUCTION DIRECTOR.....VLADIMIR V. BOBROV

DEPUTY DIRECTOR.....IGOR V. KLIMENKO

DEPUTY DIRECTOR FOR DESIGNING OF NPP .....CANDIDATE OF SCIENCES STANISLAV V. CHERNOUSOV

DEPUTY DIRECTOR FOR ECOLOGY.....ALEXANDER N. APATSKY

DEPUTY CHIEF ENGINEER.....SERGEI V. PASHCHUK

OUR ADDRESS:
5a, Romanovskaya sloboda st., Minsk, 220048
ph.: +375 17 226 52 77
fax: +375 17 226 53 17
belnipi@energoprom.by
www.belnipi.by