



**Annual  
Report**  
2018

Clean Energy





## Dear readers,

I am pleased to present to you the 2018 Annual Report of Kozloduy NPP. The publication is another opportunity to bring to the public attention performance data of the nuclear power plant in its different activity areas – providing of efficient and reliable power generation, ensuring nuclear safety, upholding the financial stability of the Company, maintaining active partnerships with colleagues from the nuclear industry in Europe and around the world, etc.

Throughout the reporting year, Units 5 and 6 had a fail-safe operation with no unplanned shutdowns. The generation of over 16 million MWh of electrical energy provided for 35% of the national electricity output.

It is the priority not only of Kozloduy NPP, but also of the national energy sector to provide a long-term perspective to the existing nuclear power units. In pursuance of this, and after justifying the possibility of continuing the operation of Unit 6 up to 60 years, in September we submitted to the Nuclear Regulatory Agency our application for Unit 6 operating licence renewal. We look forward to receiving a licence for a 10-year operational period in 2019.

In support of efforts to ensure the power units' safe and reliable operation over the coming decades, the preceding year was abundant in international cooperation events. In June, a team of the International Atomic Energy Agency conducted a pre-SALTO peer review of Unit 6 and found progress in the preparatory activities for long-term operation.

This is the place to point out that the objectives set for the year have been successfully accomplished thanks to the good organisation, high professional level and strong team spirit of the nuclear power plant employees. The positive assessment of the performance results gives confidence that Kozloduy NPP will continue to operate as it has done so far – safely and reliably, securing power supplies and contributing to the achievement of the global environmental goals facing modern society.

**Nasko Mihov,**  
Chief Executive Officer

# PRODUCTION AND MAINTENANCE PROGRAMMES IMPLEMENTATION

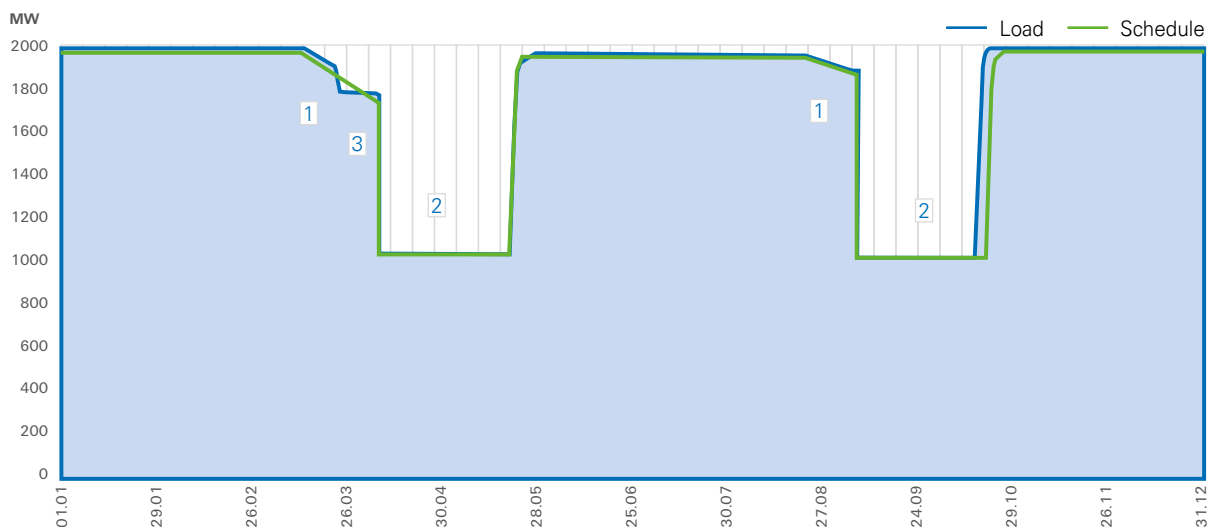


## OPERATION MODES

The 2018 performance results of Kozloduy NPP EAD speak positively of the effectiveness of the consistent policy of continuously improving the safety and operational reliability of the nuclear power units. Throughout the year, Units 5 and 6 operated with optimum loads of the generating capacities, minimum unplanned deviations from schedule, and without

any events that might impact safety or the environment. Since the successful trials completed at the end of 2017, Unit 6 has had a stable operation at increased thermal power level to 104%.

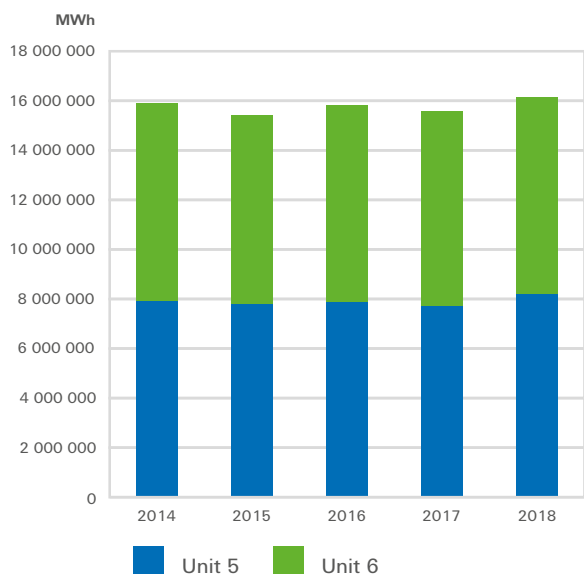
Kozloduy NPP – average daily load schedule in 2018



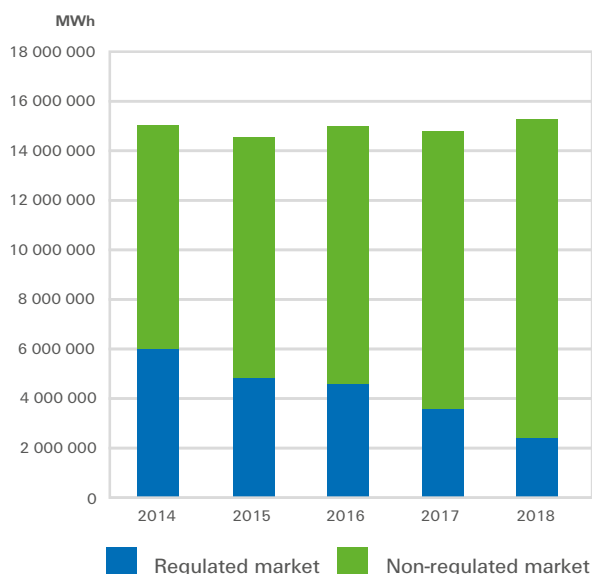
Legend: 1 – Coast down operation mode  
 2 – Scheduled annual outage with unit refuelling  
 3 – Load dispatching restriction

## GENERATION AND SALES

Electricity generated (gross)



Electricity sold (net) per market segments



In 2018, Kozloduy NPP generated a total of 16 125 281 MWh electrical power (gross), thus providing 35% of the national electricity generation throughout the year.

From the commissioning of the first nuclear power unit in July 1974 to the end of 2018, Kozloduy NPP has generated 617 509 122 MWh of electricity in total while meeting all the safety requirements governing the operation of the nuclear facilities and without any impact on the environment.

From its commissioning in 1987 to the end of 2018, Unit 5

has generated 178 307 029 MWh of electricity, while Unit 6, commissioned in 1991, has generated so far 168 206 136 MWh. The net active electricity that Kozloduy NPP supplied in the preceding year to the national grid amounted to 15 291 204 MWh, sold in compliance with the effective regulations.

In view of the Bulgarian electricity market expanding trend, in 2018, Kozloduy NPP sold 16% of its net electricity generation on the regulated market, and the rest of it was successfully traded on the free market, where the company has retained its leading



position of a major and secure electricity supplier. For the heating of on-site main activity and auxiliary facilities, and for heat supply of the town of Kozloduy, heating energy of

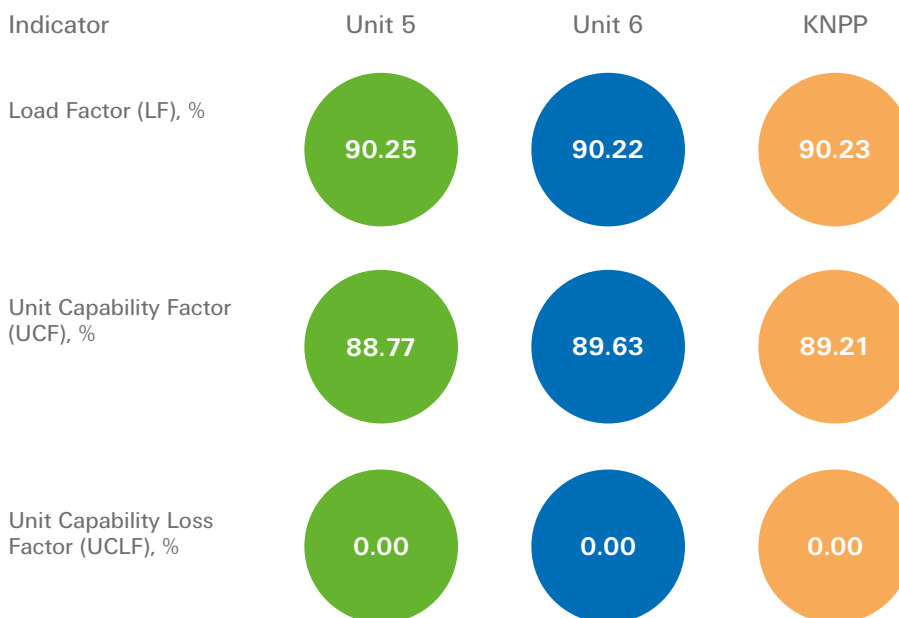
94 GWh reached the end consumers (domestic or other) in the reporting year.

## SPECIFIC PERFORMANCE INDICATORS

A set of specific indicators adopted by the World Association of Nuclear Operators (WANO) and the International Atomic Energy Agency (IAEA) is used to assess the safe and reliable operation of the nuclear power units. They permit monitoring

of the trends in the state of nuclear energy as well as drawing a comparison between nuclear power units in regular operation.

Indicators giving a comprehensive assessment of the level of reliability and safety achieved in 2018



According to the WANO criteria, values of UCF above 85% and of UCLF up to 3% are evidence of a very good level of reliability and safety in the operation of nuclear power plants as well as of high efficiency of the electricity generation.

The excellent performance values achieved by the Kozloduy NPP in 2018 confirm a lasting trend for a high level of reliability and safety due to which the Bulgarian nuclear power plant deservedly takes the lead among the world's best nuclear power plants.

Throughout the year, no unplanned events (such as shutdown, deviation from set power values or extension of scheduled outage) occurred.



## MAINTENANCE PROGRAMME

The annual maintenance programme of Kozloduy NPP comprises the necessary scope of preventive maintenance and repairs, functional tests and inspections, specialised inspections, diagnostics, and non-destructive testing of components, systems and structures of the:

- safety systems;
- systems important to safety;
- systems important to the production process.

All the activities are carried out in compliance with the licensing obligations, the technical specifications objectives for safe operation and the factory requirements in order to ensure the operational capability of the nuclear installations and the common plant facilities in the long term.

The main scope of the annual maintenance programme is performed while the units are shutdown for scheduled annual outage and refuelling, with optimum efficiency of activities' organisation in place and coordination of the teams of workers.

Along with the necessary maintenance activities in the outage, the scheduled projects are implemented as per the lifetime extension programmes and for the reactor power uprate to 104%, safety improvement, lifetime management of the equipment, as well as a number of measures for enhancing resistance to extreme external impacts.

The maintenance and upgrades planned for 2018 to ensure the safe, reliable and long-term operation of the facilities were performed up to the required quality and scope. All activities are self-financed by the nuclear power plant.

# SAFETY

## LICENSING REGIME

Kozloduy NPP EAD operates two nuclear power units – Units 5 and 6 with WWER-1000 reactors, and two storage facilities for spent nuclear fuel (SFSF) from the operation of WWER-440 and WWER-1000 reactors – a spent fuel storage facility with underwater storage technology and a dry SNF storage facility. The operation of nuclear facilities is subject to regulatory control on behalf of the Bulgarian Nuclear Regulatory Agency (NRA) at the Council of Ministers of the Republic of Bulgaria. Specialised oversight is exercised by the Ministry of Environment and Water, Ministry of Healthcare (MoH), Ministry of Regional Development and Public Works, State Agency for Metrology and Technical Surveillance and other government bodies. The nuclear installations are operated according to the provisions of the operating licences issued by the NRA. The Company maintains licences to use ionising radiation sources, licences for transport of radioactive substances and licences to conduct specialised training.

In March 2018, the NRA approved the transition of Unit 6 to a continuous operation at thermal power uprate of 3120 MW (104%) after a regulatory review and analysis of the results of the power uprating trials carried out on the unit.

On 18 September, 2018, the Kozloduy NPP applied to the Nuclear Regulatory Agency for the renewal of the operating licence of Unit 6 for a new ten-year licence period. All the applicable statutory and regulatory requirements have been observed in the preparation of the documents attached to the application. The positive experience was considered from preparing the application for Unit 5 operating licence renewal in 2017. The submitted documentation package included:

- Comprehensive justification for Unit 6 safety assurance summarising the results of the analyses and calculations made after the implementation of the plant life extension programme (PLEX) and demonstrating that Kozloduy NPP

is prepared for safe long-term operation of the unit;

- Report on the implementation of the Unit 6 PLEX Preparation Programme presenting the results of the assessment of the current status and residual lifetime of the structures, systems and components important for the long-term operation of the unit, the measures completed as per the unit PLEX Preparation Programme, and justifying the proposed new licence term;
- Summary report from the Periodic Safety Review demonstrating design compliance with the latest requirements of the relevant national regulations and internationally accepted safety standards;
- An integrated programme for implementation of safety enhancements of Unit 6 for the period 2018 – 2028, ensuing from the Periodic Safety Review and the implementation of the PLEX project;
- A new revision of the Safety Analysis Report of Unit 6 which incorporates the results and the conclusions from the performed analyses and investigations and confirms the operational capability of the unit in the new licensing period;
- Report on the implementation of the conditions in the current Unit 6 operating licence, corroborating that Kozloduy NPP has met the licensing conditions and obligations.

Following the submission of the application for Unit 6 operating licence renewal, a procedure was opened at the Nuclear Regulatory Agency, according to which a review of the submitted documents was pending.

Pursuant to the permitting regime for modifying structures, systems and components important to the safety of nuclear facilities, as defined by the Safe Use of Nuclear Energy Act (SUNEA), 31 applications were submitted in 2018 seeking





authorisation for implementing of engineering solutions on Units 5 and 6 and the spent fuel storage facility; 28 permits

were issued for introducing of modifications.

## SAFETY CULTURE

In nuclear energy, developing and upholding a high safety culture level is a key requirement for the safe operation of the nuclear facilities.

Believing that promoting and fostering of a strong safety culture is a sine qua non for enhanced safety, Kozloduy NPP implements a systematic and long-term approach that includes periodic assessment of the safety culture status, activities to enhance it, engaging all the staff and creating an attitude of responsible behaviour.

Organisation and implementation of the activities is coordinated by the Safety Culture Committee that functions in support of the Safety and Quality Director. Priority in the work of the Council is the creating of values associated with the motivation to continuously improve safety culture.

Periodic self-assessment of safety culture plays a major part in its continuous enhancement process. The overall aim is to draw a clear picture of the current situation, to assess and promote the strengths and to identify the areas for improvement in the processes and behaviour of workers by identifying concrete implementation measures as part of the safety culture continuous development activities.

Since the first safety culture self-assessment performed in 2010 – 2011 using the IAEA methodology, assessment has

become an established practice of the company. In 2018, a combined assessment was conducted of both safety culture and security culture, compliant with the provisions of relevant international and national documents on interrelation and interaction between safety and security.

In recent years good benchmarking practices have been established in a number of areas related to safety culture. In October 2018, Kozloduy NPP hosted the fourth meeting in a row with representatives of Cernavoda NPP (Romania) and Paks NPP (Hungary). Along with the main topic of the meeting – safety culture, the participants reviewed issues related to management, knowledge transfer and retention, human resources management and the integrated risk assessment. These meetings have been traditionally evaluated by attendees as beneficial, open and contributing to better performance in the efforts to enhance safety culture.



## NUCLEAR SAFETY

In 2018, there were no actuations of the reactor protection systems of Units 5 and 6. Four operating events were registered and reported to the NRA. All of them were rated level 0 as per the INES scale (events without safety significance). Based on the causes identified during the analyses, corrective measures were defined in order to avoid recurrence. The operation of the nuclear power units meets the conditions of the licences issued by the NRA, the

requirements of the technical specifications and the operating instructions. No breaches have been made of the operational limits and conditions for safe operation. Monthly functional tests of the safety systems have confirmed compliance of the test results with the technical specifications of the power units.

## RADIATION PROTECTION

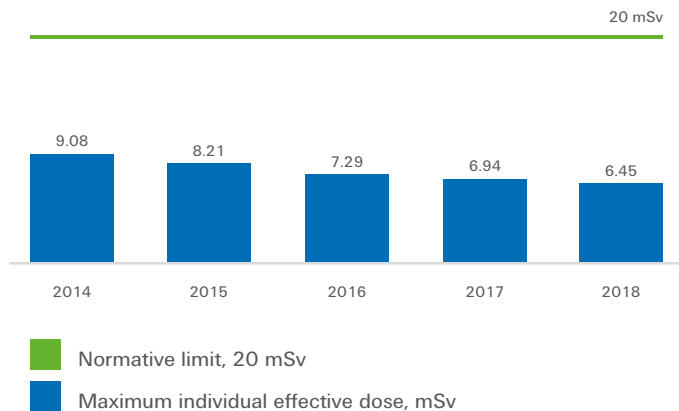
In pursuance of its priority to ensure the highest level of safety in its activity, Kozloduy NPP maintains a policy of continual improvement and optimisation of the radiation protection measures.

This is achieved through personnel training and motivation, use of good practices from own and international operating experience, accurate planning and analysis of the completed activities, and reliable and efficient radiation monitoring.

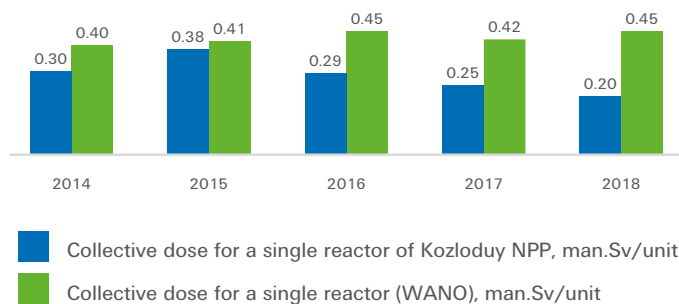
The annual values for individual and collective radiation exposure in 2018 prove the effectiveness of the radiation protection measures applied. Regardless of the performance of a series of complex activities inside the controlled area related to Unit 6 lifetime extension, the maximum individual

dose in the year was 6.45 mSv, which represents 32% of the statutory annual limit and is lower than the value in the previous reporting year. The personnel collective dose exposure was also lower compared with the results over the past five years. In 2018, the total collective dose measured at the two WWER-1000 reactors was 0.41 man.Sv, or 0.20 man.Sv, on average, per reactor. Data from the annual WANO reports for 2018 show that the average annual collective dose intake during the operation of one similar type of reactor (PWR) was 0.45 man.Sv. The reported result shows that the collective dose for a single reactor at Kozloduy NPP has kept the trend of staying lower than the WANO indicator in a consecutive year.

Maximum individual effective dose in the Kozloduy NPP radiologically controlled area, mSv



Collective dose for a single reactor of Kozloduy NPP, compared to the WANO indicator, man.Sv/unit

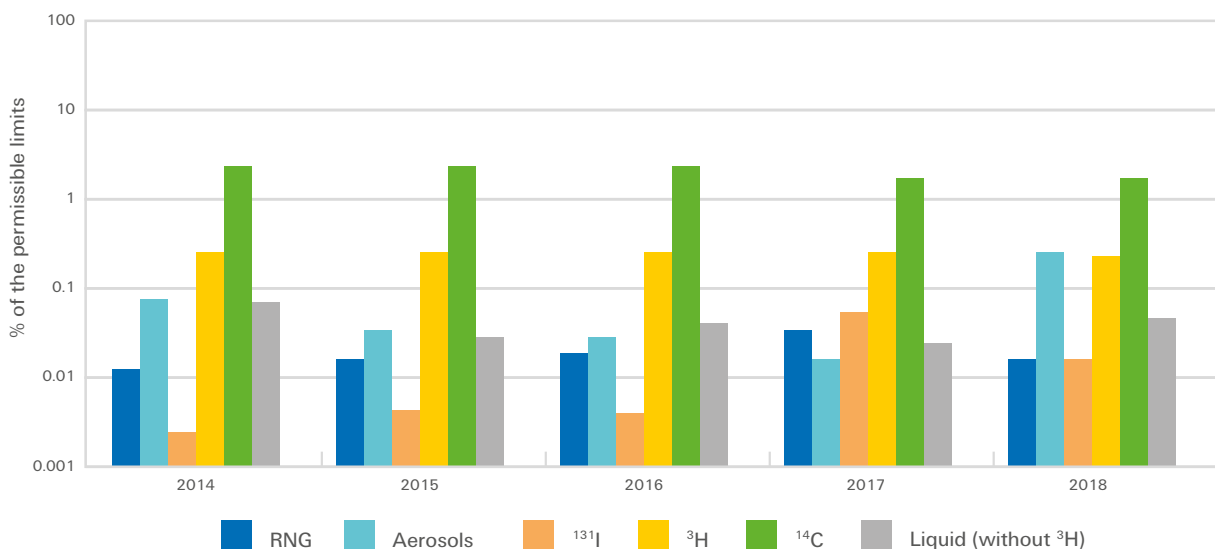


## RADIATION MONITORING OF EMISSIONS DISCHARGED TO THE ENVIRONMENT

The results of the radiation monitoring of liquid and gaseous discharges, carried out in accordance with the highest international standards, demonstrate the high level of control applied to the technological processes in Kozloduy NPP. Along with this, the discharges in the environment are monitored also by the Nuclear Regulatory Agency, the Ministry of Environment and Water (MEW), and the National Centre of Radiobiology and Radiation Protection (NCRPP). In addition, Kozloduy NPP has specified reference levels which are significantly lower than the admissible levels. The information is reported to the European Commission on an annual basis. The steady trend continued for the emissions of radioactive

noble gases (RBG) and radioactive aerosols to remain well below the established limits: in 2018, the value was 0.2% of the reference levels. The emission of iodine-131 ( $^{131}\text{I}$ ) was below 0.02% of the reference level. The tritium levels ( $^3\text{H}$ ) in the exhaust air did not exceed 0.2% of the reference limits. The results for liquid effluents were also considerably lower than the reference levels – 0.04% of the annual limits for secondary circuit liquid effluents.

Total activity of airborne (RNG, aerosols,  $^{131}\text{I}$ ,  $^3\text{H}$  and  $^{14}\text{C}$ ) and liquid effluent discharges, in % of the annual limits set for the site



## RADIOACTIVE WASTE MANAGEMENT

In 2018, the plans for the transfer and processing of all currently generated solid radioactive waste (RAW) and liquid evaporator concentrate as well as the phased retrieval of historical RAW from repositories were fulfilled according to the approved schedules. The quantities envisaged per design were not exceeded.

In 2018, 526 m<sup>3</sup> of compactible solid radioactive waste and

32.5 tons of non-compactible solid radioactive waste were generated. The retrieval of solid RAW from temporary storage facilities located in the EP-2 Auxiliary Building 3 is ongoing, and a total of 100 m<sup>3</sup> waste was handed over during the year. Water treatment generated 184 m<sup>3</sup> of liquid radioactive concentrate.

## SPENT NUCLEAR FUEL MANAGEMENT

Spent nuclear fuel (SNF) at Kozloduy NPP is stored in compliance with all safety requirements. After being kept for a certain period in the Spent Fuel Pools (SFP) located at the reactors, the fuel is transferred to the 'pool type' spent nuclear fuel storage facility (WSF), which is common for all the units. The Dry Spent Fuel Storage Facility (DSFSF) stores spent nuclear fuel from units 1, 2, 3, and 4 loaded in advance in Constor 440/84 casks in the SFSF.

During the annual outage on Unit 5, one transport of spent fuel assemblies was performed from SFP-5 to the WSF. No SF assemblies were moved from SFP-6 to the WSF. One cask loaded with WWER-440 spent fuel assemblies was transported from WSF to the DSFSF.

In 2018, on behalf of the Nuclear Regulatory Agency, the International Atomic Energy Agency and the European Commission a total of nine inspections were carried out of the spent nuclear fuel at Kozloduy NPP Units 5 and 6, WSF, and DSFSF.



## EMERGENCY PLANNING AND PREPAREDNESS

An important element in ensuring the nuclear power plant safety is the upholding of a high level of emergency preparedness of the personnel. To this end, the required trainings, exercises and drills are performed.

In 2018, the Kozloduy NPP Emergency Plan was updated. Training in topics related to emergency planning and emergency preparedness was conducted with 1503 people. Five drills with the NRA and three with SE RAW, as well as two joint exercises were carried out.

In the preceding year, Kozloduy NPP hosted three experience sharing visits concerning Emergency Planning and Emergency Preparedness. As part of the activities of the Moscow Centre of the World Association of Nuclear Operators (WANO – MC), the activities of the Bulgarian power plant in this field

were presented to experts from the Belarusian NPP and the Ukrainian National Nuclear Energy Generating Company "Energoatom", the Zaporozhye and Khmelnytski NPPs. At the initiative of the International Atomic Energy Agency, a specialised training in the same field was also delivered by a representative of the Croatian regulatory body.

As part of the measures planned for the population in the region surrounding the nuclear power plant, 680 students and 50 lecturers from the schools in Kozloduy, Glozhene and Hurllets were trained during the year. The Nuclear Power Plant provided the necessary personal protective equipment for schools and kindergartens in the municipality of Kozloduy and the municipality of Mizia.



## PHYSICAL PROTECTION

A state-of-the-art, reliable physical protection system has been set up at Kozloduy NPP to effectively prevent undue impacts, as well as provide general safety at the nuclear power plant. All necessary technical and organisational measures, means and methods are applied in accordance with the relevant national and international requirements.

In 2018, the Kozloduy NPP continued the modernisation process of the technical security systems. Additional measures were introduced to increase the security of computer-based systems used for physical protection purposes. The project for the modernisation of the NPP checkpoints is running on schedule.

Particular attention is paid to the good training of the staff

involved in ensuring the security of the nuclear power plant. Specialised trainings and monthly drills were held as planned for the year. The planned activities for nuclear safety culture development and enhancement are being implemented to schedule, in the wake of the first in the world self-assessment of nuclear security culture conducted at Kozloduy NPP in 2015 using the methodology of the International Atomic Energy Agency.

No violations of the Kozloduy NPP physical protection system were committed in 2018. The assessments made by the NRA on the effectiveness of the physical protection system, and the security assessment carried out by the Ministry of the Interior confirmed that it fully meets the design requirements.

## FIRE SAFETY



The fire safety assurance activities of the Kozloduy NPP are carried out by applying a complex of technical and organisational practices in accordance with national standards and international requirements. In 2018, no fires or ignitions occurred on the plant site. A total of 534 internal inspections were carried out to check compliance with the fire safety rules and standards, which resulted in identification of the necessary preventive measures. As regards fire safety of construction works, 135 terms of reference were agreed and 81 opinions issued on the subject.

Over the year, the process of fire alarm systems replacement continued: up-to-date fire detection systems were installed in the reactor compartment, the turbine hall of Unit 6 and in Auxiliary

Building 3. A project was launched for the construction of a redundant charging station for air-breathing devices for the needs of the Regional Service for Fire Safety and Public Protection – Kozloduy NPP and for the staff of the plant.

The necessary fire safety assessment of the activities of all external organisations was carried out as well as construction supervision during the implementation of the joint projects. The operations personnel received continuous training on fire safety.

The inspection made by the Regional Directorate for Fire Safety and Public Protection in Vratsa confirmed the observance of the fire safety regulations and norms in the Company.

## RADIOECOLOGICAL MONITORING

The environmental radiological monitoring carried out by Kozloduy NPP fully complies with the national and European normative requirements in this field and corresponds to the experience and good practice in the countries with developed nuclear energy. There is a full compliance with the requirements of Article 35 in the Euratom Treaty and Recommendation 2000/473/Euratom. The organisation and scope of control includes main components which are significant for the protection of public health and environmental condition. The control process employs accurate and methods recognised in practice. The quality of the conducted analyses and measurements is ensured by interlaboratory comparisons at national and international level and the results are verified by independent studies of the national control and supervisory bodies – the National Centre of Radiobiology and Radiation Protection at the Ministry of Health, and the Executive Agency for the Environment at the Ministry of Environment and Water.

The monitored area includes the plant industrial site, 2-km Precautionary Action Zone (PAZ), the Bulgarian section of the 30-km surveillance zone, and monitoring reference points within the 100-km radius of the Bulgarian territory surrounding the plant. The gamma radiation background is continuously measured at settlements in the area and broad public access to information on the radiation conditions is provided.

In 2018, more than 4200 analyses of over 2500 samples from different environmental sites and more than 1200 gamma background measurements were performed. The obtained results fall within the background levels range that is typical for this region. The registered values were many times below the admissible norms for the relevant indicators and investigated sites, which confirms that the radiation conditions have not been affected by the operation of the NPP.

In 2018, the gamma background levels at the on-site monitoring points and the measurement points within the 100-km zone were fully comparable with and did not deviate from the natural gamma background levels specific for the region. To notify the public living in the 30-km zone, there is

an automated information system for radiological monitoring with a total of 14 local measuring stations installed in different populated areas. The data are displayed on information boards installed in public places, and are transmitted through a wireless, on-line connection to the central station at Kozloduy NPP, and thenceforth to the Executive Environment Agency. In 2018, the atmospheric air human-induced activity had values close to the background ones ( $2 \mu\text{Bq}/\text{m}^3$ , on average) which was many times below the permissible limits. The total beta activity of the water from natural water bodies ranged between  $<0.03 - 0.11 \text{ Bq}/\text{l}$ , which is below 30% of the maximum permissible limit of  $0.5 \text{ Bq}/\text{l}$  stipulated in Regulation H-4/2014. The mean annual activity of tritium in the samples from open ponds was  $6.5 \text{ Bq}/\text{l}$ . The radiation status of drinking water complied with the health standards (Regulation No. 9 of 16 March 2001). The total beta activity measured in local drinking water sources varied from 0.019 to  $0.24 \text{ Bq}/\text{l}$ . No tritium or other human-induced activity was registered in the drinking water catchments. No impact of the NPP was established on the radio-ecological status of soils in the area.

The radioactivity of the staple foods produced in the region, such as milk, agricultural crops, etc., was within normal background radiation levels, much below the relevant permissible limits (Regulation No. 10 of 2002). The human-induced activity of fish in the Danube river, upstream and downstream Kozloduy NPP site, is also examined. The results were consistent with the data from the previous years of operation, and with the period preceding the plant first start-up, which confirms the absence of impact from Kozloduy NPP on the staple foods and ichthyofauna in the region.





## PUBLIC DOSE EXPOSURE EVALUATION

In recent years, the values of the maximum annual individual effective dose to the public have varied within the range of  $4 \div 7 \mu\text{Sv/a}$ . The results are comparable with those for the nuclear power plants both in the European Union, and worldwide. In 2018, the maximum individual effective dose to a critical group of the population in the surveillance zone, in total from airborne and liquid discharges from Kozloduy NPP to the environment, was conservatively evaluated at  $5.46 \mu\text{Sv/a}$ . This value is only 0.23% of the exposure value due to the natural background radiation for the country ( $2.33 \text{ mSv/a}$ ), and 0.55% of the statutory limits as per the Regulation on Radiation Protection ( $1 \text{ mSv/a}$ ).

The analytical process employed verified and validated modelling codes for analysis based on the CREAM methodology approved by the European Union and adapted to the relevant geographical and hydrological specifics of the Kozloduy NPP region. The results get verified through independent control on behalf of NCRPP, at the MoH, and compared with data of evaluated doses to the public that are periodically published by the European Commission for the nuclear power plants of the EU member-states. The data have a very good consistency with those reported from other EU nuclear power plants.

## ENSURING OCCUPATIONAL HEALTH AND SAFETY

One aspect that measures the employer's responsibility to its employees is maintaining health and safety at work, and protecting and preventing occupational risks.

Being a responsible employer, Kozloduy NPP has adopted a modern approach aimed at implementing highly effective health and safety measures, enhancing the safety culture of workers and building an awareness-based behaviour of compliance with the safety requirements. The requirements of the laws and regulations of the Republic of Bulgaria on occupational health and safety are strictly adhered to, and the best international practices in this field are applied.

Kozloduy NPP has developed long-term industrial safety and risk assessment programmes that have been harmonised with the country's normative framework, the recommendations of the International Atomic Energy Agency, and relevant international practices. The programmes include all activities related to legal obligations and cover the protection and prevention of occupational hazards arising from work processes, work equipment and the working environment in all aspects of the nuclear power plant activities – operation, maintenance, repairs, etc.

Risk assessment at the working places is systematically conducted and the implementation of the prescribed measures reported. To eliminate or limit harmful factors to the maximum extent, working environment parameters are measured by laboratories and their compliance with the normative requirements is assessed.

Concerning health protection measures, priority is given to prevention and promoting of safety improvements at work.

Special attention is paid on training and maintaining of the personnel awareness. It is mandatory to employ only individuals with the required education, qualification or licence. Workers periodically undergo training on safety at work, as well as the necessary briefings – pre-job, at the workplace, periodic, daily and extraordinary ones.

The workers at the nuclear power plant receive the necessary specialised working clothing and personal protective equipment, in accordance with the statutory and safety regulations. At work rooms and workplaces no exceedance is allowed of the established norms and standards regarding the production microclimate, noise, vibration, dust, toxic substances, lighting, non-ionizing and laser radiation.

The Occupational Medicine Service has been set up at the nuclear power plant to assist the employer in ensuring health and safety at work and to provide quality healthcare to the personnel. It operates a medical emergency team providing 24-hour medical care at the site of the nuclear power plant (including urgent and emergency medical care).

The Working Conditions Committee at the nuclear power plant acts as a consultative body of the plant CEO on matters regarding health and safety at work. The Committee participates in the formulation of the health and safety policy guidelines and the strategy for its implementation, discusses the results of the occupational risk assessment and the workers' health status analysis, performs inspections for compliance with the requirements for health and safety at work, tracks the implementation of the proposed measures, etc.

As a result of the implemented measures and in confirmation of their effectiveness at Kozloduy NPP there has been a steady decreasing trend of the days-away case rate due to industrial injuries.

The industrial injuries coefficient for Kozloduy NPP has maintained low values for years – 0.33 in 2018. This is significantly lower than the average for the industry – 1.11, and the average for the country – 0.66.





## ENVIRONMENTAL MANAGEMENT

Protection of the environment and rational usage of natural resources with the aim of preserving and conserving ecosystems and public health are priorities of the plant environmental policy and their realisation is through specific ecological programmes and activities. Through a system of activities, measures and facilities, protection of air purity, water protection and management, waste management, minimisation of the risk of occurrence of environmental damage and incidents is achieved.

The Environmental Management System has been introduced as a tool for environment management and control. This system is an integral part of the Kozloduy NPP Integrated Management System.

As provided in the applicable national legislation, the company has been issued and updated the required environment related permits – for water usage and discharge of waste waters, for greenhouse gas emissions, for transport and disposal of non-radioactive wastes, etc.

In pursuance of the permits issued for water usage and waste water discharge, samples from surface, ground and waste waters were taken and analysed according to the Programme for Plant Monitoring of Waters during the Operation of Kozloduy NPP, and the Programme for Monitoring of Landfill for Non-Radioactive Household and Industrial Waste. The number of samples collected was 594, and of the analyses made – 2279. The analyses in 2018 were performed at certified laboratories: Regional Laboratory – Vratsa with the Executive Environmental Agency; laboratories of the Engineering Chemistry Section, Quality Division, and the Radioecological Monitoring Department, at the plant Safety Division. Results from the plant non-radiation monitoring demonstrate full compliance with the individual emission limits set in the licences.

Under the Non-Radioactive Waste Management Programme, in 2018, a waste pick-up machine and 100 metal wheelie bins for household waste were purchased and located outside the perimeter fence. The system for separate collection of waste packages was expanded and 210 coloured waste bins (70 sets) were additionally purchased. The wastes collected over the year were transferred to licensed external organisations for further safe treatment.

Since March 2017, stage 2 of the Kozloduy NPP own landfill for non-radioactive household and industrial waste has been in operation. It has a design lifetime until 2031. As at the end of 2018, 9.6% of the design capacity of the landfill stage 2 was filled, namely 28 460 m<sup>3</sup>.

In 2018, a total of 10 inspections were conducted by the respective control bodies – 3 by the Regional Inspection of Environment and Waters – Vratsa, and 7 by the Basin Directorate for the Danube Region, located in Pleven. These inspections did not find any breaches and, therefore, prescribed no corrective actions.

Last year, the company participated in the celebrations of 5<sup>th</sup> June – World Environment Day and 29<sup>th</sup> June – Danube Day, through a series of initiatives. More than 150 Kozloduy NPP employees, representatives of the Basin Directorate for the

Danube Region, in Pleven, the Kozloduy Municipality and many guests and friends participated in the festive events.

The prestigious award in the national competition “The Greenest Companies in Bulgaria” in the category “Energy, Water Sector” came as a high recognition of the environmental policy of the Kozloduy Nuclear Power Plant.

Greenhouse gas emissions saved in 2018 by Kozloduy NPP compared to conventional thermal power plants (in thousand tons)



# PROGRESS ON THE LIFETIME EXTENSION PROJECT OF UNITS 5 AND 6 AT KOZLODUY NPP



In 2018 the next step was made to the successful completion of the plant lifetime extension (PLEX) project of Kozloduy NPP Units 5 and 6.

On 25 July, 2018, an official announcement was made of the conclusions in the justification of the possibility for extending the operational life of Unit 6 to 60 years. The analyses and calculations made indicate that the structures, systems and components of the power unit are in good operating condition and can safely operate up to 2051.

In the process of preparing the PLEX justification for Unit 6, all the necessary safety analyses were performed, calculations and quantitative evaluation of the residual life of the facilities related to the safe and reliable operation of the unit. The assessment scope covered the reactor unit equipment, reactor, pressuriser, steam generators, main coolant loops, pumps, valves, pipelines, diesel generators, civil structures of a number of items, the reactor building, and many others. Thanks to the good organisation, all the activities were completed in due time and in accordance with the normative documents specifications.

On 18 September, 2018, the Kozloduy NPP applied to the Nuclear Regulatory Agency for the renewal of the operating licence of Unit 6 for a new ten-year licence period, which is the maximum statutory time limit. The application package included all the documents prepared in conformity with the regulatory requirements and licensing conditions. The application filed to the NRA marked the successful completion of the large volume of work on the Unit 6 preparation for safe long-term operation after the expiry of its design lifetime in 2021.

The comprehensive justification for safety assurance of Unit 6 presents the results from analyses and calculations made after completing the plant lifetime extension programme.

The report on the implementation of Unit 6 PLEX programme,

submitted to the Nuclear Regulatory Agency, presented the assessment results of the current state and residual lifetime of the structures, systems and components important for the long-term operation of the unit, the measures completed as per the unit PLEX Preparation Programme, and justified the proposed new licence term.

The Periodic Safety Review (PSR) of Unit 6 covered all safety aspects. The preparation of the document, which is in essence a systematic reassessment of all safety factors considered in the design and the operation of the nuclear facility, is a mandatory prerequisite for any licensing preparation process. The results of the Periodic Safety Review confirm the safe operation of the unit over the next licensing period as well as the high level of nuclear, radiation and technological safety commensurate with the level of the best nuclear power plants. The design and operational practice comply with the national legislation and international safety standards of the International Atomic Energy Agency and of the Western European Nuclear Regulators Association (WENRA).

A Summary Report from the Periodic Safety Review was also issued justifying the safe operation of Unit 6 and demonstrating design compliance with the latest requirements in the relevant national normative documents and of the internationally accepted safety standards. A Comprehensive Programme for implementation of the measures ensuing from the PSR was submitted to the NRA. An essential component of the documentation package submitted to the Nuclear Regulatory Agency was the Integrated Programme for implementation of safety enhancements of Unit 6 in the period 2018 – 2028, arising from the Periodic Safety Review and the implementation of the PLEX project.

The report on the implementation of the conditions in the current Unit 6 operating licence corroborates that Kozloduy NPP has met the licensing conditions and obligations.

A new revision of the Safety Analysis Report of Unit 6 was issued to incorporate the results and the conclusions from the performed analyses and investigations confirming the operational capability of the unit in the new licensing period.

It is expected the the NRA will issue a new ten-year operational licence to Unit 6 in the autumn of 2019.

The project for lifetime extension of Unit 5 was successfully completed, and on 3 November 2017, the plant obtained from the NRA its operational licence for the next 10 years.

After the Units 5 and 6 PLEX Project activities were completed, a new revision of the Project Management Plan was prepared to include action items for implementation in the long-term operation period.

All the Project activities scheduled for implementation during the power units' 2018 annual outages were completed.

The funding of the plant life extension project for the units is provided in the plant Business Programme, and the activities' implementation is fully self-financed.

## ACTIVITIES COMPLETED ON UNIT 5

During the annual outage the efforts were focused on performing activities related to the long-term operation of the unit. The pump for planned/emergency core cooling was replaced by a new type. Activities were carried out for replacement of racks, sensor

pulse signal lines and cables. Recertification was performed of equipment for the power supply apparatuses of the reactor control and protection system, etc.

## ACTIVITIES COMPLETED ON UNIT 6

The technical condition was verified of the in-core monitoring system, and of the reactor emergency protection and preventive protection instrumentation. The reactor neutron flux monitoring equipment has been recertified. Activities were carried out for replacement of racks, sensor pulse signal lines and cables. The housings and removable parts of 41 valve assemblies and

check valves were replaced. The main flange was upgraded of the primary circuit main coolant pump. Overhaul and condition survey of the third low pressure cylinder of the turbine were undertaken. Rehabilitation and restoration were accomplished on the anticorrosion coating of the ventilation stack and the steel structures of the reactor building.



# INVESTMENT PROGRAMME PERFORMANCE OVERVIEW



The main priority of the Investment Programme (IP), which forms part of the Company's Business Programme, is the implementation of activities ensuing from the provisions of the Safe Use of Nuclear Energy Act and the effective operational licences of the nuclear facilities.

This guarantees the high safety level of Kozloduy NPP comparable to that of the best nuclear power plants worldwide, and ensures the stable and reliable operation of the largest power generation enterprise in the country, acting as a determining factor for the stability of the national energy system.

Three-, six-month and annual reports on the progress on the IP measures are issued to the Nuclear Regulatory Agency, the Ministry of Energy and BEH EAD.

The 2018 Investment Programme performance used BGN 54 006 thousand of self-financing. The long-term assets commissioned had a value of BGN 104 338 thousand.

In compliance with the SUNEA provisions and the operational licences, all the planned investment activities were completed upholding and enhancing safety at the nuclear power plant. The accomplished activities were related to the strategic projects for plant life extension of Units 5 and 6 to operate over the next 30-year period, and for improving the production efficiency through enhancing the units' design power to 104%. All the investment activities were completed as needed for ongoing maintenance of the units, the auxiliary facilities and the infrastructure, as well as measures to uphold and strengthen the plant security and

physical protection.

A total of BGN 8 176 thousand were invested in activities regarding Kozloduy NPP overriding priority – maintain and heighten safety of the nuclear facilities.

The costs that went towards investments in the Units 5 and 6 lifetime extension project amounted to BGN 5 190 thousand. The funds invested as per the IP activities for increasing the thermal power of the reactor unit to 104%, amounted to BGN 1 873 thousand.

For tasks related to the maintenance of major and auxiliary facilities, important for the production activity, as well as for ensuring the normal operation of the sites, during the reporting year BGN 38 767 thousand were invested.

In 2018, the number of acceptance committee actions was 22, of which 21 plant acceptance committees whose work was reported in site acceptance protocols, and one state acceptance committee that covered three sites and ended with signing of Protocol 16 and issuance of a utilisation permit on behalf of the Directorate for National Construction Supervision.

# FINANCIAL PERFORMANCE



In the context of the Company's financial and economic management policy aimed at achieving cost-effective and competitive power generation whilst ensuring the highest level of safety, maintaining stability and constant striving for improvement of its financial position, Kozloduy NPP EAD ended 2018 with excellent financial and economic parameters.

During the reporting year, opportunities were ensured to maintain high amount of net monetary exposures in the Company. Thanks to the policy of effective and efficient management of the financial resources, favourable solvency and liquidity levels were maintained on a continuous basis.

In 2018, the plant reported total revenue of BGN 1 117 million, which exceeds that of the previous year by BGN 187 million. The exceedance is due to the higher revenues from electricity sales at the deregulated market segments, which amounted to BGN 967 million, marking a significant nominal increase of BGN 203 million compared to 2017. Revenues increase is the result of both change in the market sales structure (the prevailing share of exchange transactions), as well as the higher selling prices in 2018, in spite of the reduced consumption in the country compared with 2017.

The revenues from sales at regulated prices in 2018 amounted to BGN 131 million, with a drop of BGN 15 million compared to the previous year, as a result of the decreased electricity sales quota of the public supplier, NEK EAD, as of 01.07.2018.

In 2018, the operating expenses of the company amounted to BGN 939 million, with an augmentation of BGN 140 million compared to the previous year. The increased costs are mainly due to the increased contributions to the Nuclear Facilities Decommissioning Fund (NFDF), Radioactive Waste Fund (RAWF) and Electricity System Security Fund (ESSF),

which resulted of the increased revenues from the sales of electricity and accrued expenses for a provision for the obligation to transport spent fuel from WWER-1000 for technological storage and processing in accordance with the Strategy for SNF and RAW Management by 2030.

The profit after taxes of Kozloduy NPP amounts to BGN 164 million compared to a profit of BGN 118 thousand, recognised for the year 2017.

Kozloduy NPP continues to pursue its effective policy of debt management. In 2018, repayment instalments of principal and interest were paid to the amount of BGN 41 million towards a Loan Agreement with Euratom, dated 2000, under the Modernisation Programme for Power Units 5 and 6.

The nuclear power plant closed the year 2018 without any overdue payments. Financing was provided of the Company's priority activities related to the safe operation of the nuclear facilities and the implementation of the investment projects for Units 5 and 6 lifetime extension and their thermal power uprate. All due payments for securing the next fuel campaigns of the two units in operation, obligatory insurance premiums, payments to Nuclear Facilities Decommissioning Fund, Radioactive Waste Fund, and Electricity System Security Fund, were effected in time. The commitments were fulfilled to the personnel and insurance institutions as well as the obligations under commercial contracts for the implementation of the Maintenance Programme and Investment Programme. In 2018, BGN 431 million were paid to the state and municipal budgets. That included the payments of BGN 114 million to the RAW, NFD, and ESS Funds, BGN 215 million for taxes and fees, BGN 48 million for social security and health insurance contributions.

As at 31.12.2018, Kozloduy NPP EAD had BGN 240 million cash liquidity, exceeding the amount recognised in the end of

2017 by BGN 62 thousand. The significant factors influencing the cash amount are the increased receipts from unregulated sales due to the favourable market trends during the year and the additional dividend for 2018 paid by BEH EAD to the amount of BGN 220 million.

A table presents key indicators of the results from the company's activity and evaluation of the condition and performance of Kozloduy NPP in 2018 in comparison with the preceding year.

<b>Item No</b> <b>c.1</b>	<b>BGN'000</b> <b>c.2</b>	<b>Statement as at 31.12.2018</b> <b>c.3</b>	<b>Statement as at 31.12.2017</b> <b>c.4</b>	<b>Change 2018/2017 (%)</b> <b>c.5=(c.3/c.4)-1</b>
1	Total operating income	1 117 285	930 398	20.09%
2	Total operating expense	(939 273)	(799 605)	17.47%
3	EBITDA <sup>1)</sup>	376 583	322 171	16.89%
4	EBIT <sup>2)</sup>	178 012	130 793	36.10%
5	EBT <sup>3)</sup>	181 032	130 127	39.12%
6	EBIT margin	15.9%	14.1%	12.77%
7	EBITDA margin	33.7%	34.6%	-2.60%
8	Total assets	3 261 379	3 396 750	-3.99%
9	Non-current tangible assets <sup>4)</sup>	2 544 339	2 657 603	-4.26%
10	Working capital <sup>5)</sup>	438 370	465 861	-5.90%
11	Cash and cash equivalents <sup>6)</sup>	239 725	178 211	34.52%
12	Equity	2 611 209	2 721 473	-4.05%
13	Return on equity <sup>7)</sup>	6.93%	4.78%	44.98%
14	Return on assets <sup>8)</sup>	5.55%	3.83%	44.91%

<sup>1)</sup> EBITDA – earnings before interest, taxes, depreciation and amortization

<sup>2)</sup> EBIT – earnings before interest and taxes

<sup>3)</sup> EBT – earnings before taxes

<sup>4)</sup> TA – tangible assets

<sup>5)</sup> Working capital – current assets minus current liabilities

<sup>6)</sup> Cash and cash equivalents reflecting the effect from IFRS 9;

<sup>7)</sup> Return on equity – EBT/Equity

<sup>8)</sup> Return on assets – EBT/Total assets

## SEPARATE STATEMENT OF FINANCIAL POSITION

	<b>Assets</b>	<b>31 December 2018</b>	<b>31 December 2017'</b>
<b>Non-current assets</b>	Property, plant and equipment	2 544 339	2 657 603
	Intangible assets	9 732	11 170
	Investment property	4 100	4 095
	Investments in subsidiaries	15 161	15 161
	Loans granted to related parties	9 751	12 740
	Related parties receivables	7 529	23 039
	Non-current trade and other receivables	3 261	5 123
	Equity instruments at fair value through other comprehensive income (OCI)	466	232
	<b>Non-current assets</b>	<b>2 594 339</b>	<b>2 729 163</b>
<b>Current assets</b>	Nuclear Fuel	213 962	235 443
	Inventory	60 018	58 762
	Trade and other receivables	43 192	37 372
	Loans granted to related parties	2 334	2 374
	Related parties receivables	107 809	155 425
	Cash and cash equivalents	239 725	178 211
		<b>Current assets</b>	<b>667 040</b>
	<b>Total assets</b>	<b>3 261 379</b>	<b>3 396 750</b>
	<b>Equity</b>		
<b>Equity and Liabilities</b>	Share capital	244 585	244 585
	Statutory reserves	24 458	19 785
	Revaluation reserve of non-financial assets	1 400 874	1 384 245
	Reserve from remeasurements of defined benefit plans	(45 698)	(35 095)
	Reserve of fair value equity instruments remeasurements	211	-
	Other reserves	826 667	984 126
	Unallocated profit	160 112	123 827
	<b>Total equity</b>	<b>2 611 209</b>	<b>2 721 473</b>
	<b>Liabilities</b>		
<b>Non-current liabilities</b>	Loans	33 127	66 132
	Retained amounts under construction contracts	863	159
	Financing	154 616	179 950
	Liabilities for retirement employee benefits	50 665	49 752
	Non-current trade and other liabilities	18 656	-
	Deferred tax liabilities	163 573	177 558
	<b>Non-current liabilities</b>	<b>421 500</b>	<b>473 551</b>
<b>Current liabilities</b>	Trade and other payables	122 847	131 234
	Related parties payables	1 589	9 079
	Loans	33 890	40 056
	Financing	4 435	6 054
	Retained amounts under construction contracts	4 971	5 034
	Liabilities for retirement employee benefits	14 423	8 333
	Provision for spent nuclear fuel and others	41 775	668
	Income tax payable	4 740	1 268
	<b>Current liabilities</b>	<b>228 670</b>	<b>201 726</b>
	<b>Total liabilities</b>	<b>650 170</b>	<b>675 277</b>
	<b>Total equity and liabilities</b>	<b>3 261 379</b>	<b>3 396 750</b>

**SEPARATE STATEMENT OF PROFIT OR LOSS AND OTHER COMPREHENSIVE INCOME FOR THE YEAR ENDED 31 DECEMBER**

	<b>2018 BGN'000</b>	<b>2017* BGN'000</b>
Revenue from electricity sales	1 099 058	909 712
Revenue from thermal energy sales	2 007	2 138
<b>Revenue from sales of produce</b>	<b>1 101 065</b>	<b>911 850</b>
Revenue from financing	5 560	5 615
Other revenue and income	10 660	12 933
Cost of materials	(151 929)	(145 770)
Hired services costs	(131 497)	(120 828)
Employee benefits expenses	(220 691)	(204 479)
Depreciation and amortisation, and subsequent evaluation of PPE	(198 571)	(191 378)
Provisions costs	(41 118)	(668)
Impairment costs/reversed impairment on financial assets (net)	(6 239)	5 793
Other costs	(187 177)	(146 401)
Change to work in progress	(2 163)	3 244
Acquisition of machinery, plant and equipment on free market commercial basis	112	882
<b>Profit from operating activity</b>	<b>178 012</b>	<b>130 793</b>
Financial costs	(2 526)	(3 532)
Financial income	5 546	2 866
<b>Profit before tax</b>	<b>181 032</b>	<b>130 127</b>
Income tax expense	(17 486)	(12 430)
<b>Profit for the year from continuing operations</b>	<b>163 546</b>	<b>117 697</b>
Profit for the year from discontinued operations	-	202
<b>Profit for the year</b>	<b>163 546</b>	<b>117 899</b>
<b>Other comprehensive income</b>		
<b>Items that will not be reclassified subsequently to profit or loss</b>		
Remeasurements of the liabilities under defined benefit plans	(11 781)	(5 079)
Remeasurement of non-financial assets	18 969	-
Equity instruments at FVOCI - change in fair value		
– current period losses	(59)	-
Income tax related to items not reclassified to profit or loss	(713)	508
<b>Other comprehensive income/(loss) for the year, net of tax</b>	<b>6 416</b>	<b>(4 571)</b>
<b>Total comprehensive income for the year</b>	<b>169 962</b>	<b>113 328</b>

\* The Company started applying IFRS 9 and IFRS 15 as of 1 January 2018. Under the transition methods chosen, the comparative information is not restated.



## SEPARATE CASH FLOW STATEMENT FOR THE YEAR ENDED 31 DECEMBER

	<b>2018</b>	<b>2017</b>
	<b>BGN'000</b>	<b>BGN'000</b>
<b>Operating activity</b>		
Proceeds from customers	1 305 614	1 008 644
Payments to suppliers	(297 655)	(299 882)
Payments to personnel and social security institutions	(208 289)	(191 548)
Payments to fees, commissions, and the like	(36)	(27)
Payments to the RAW, NFD, and ESS Funds	(168 138)	(138 971)
(Payments to)/Proceeds from income tax	(28 310)	(15 437)
Cash flows related to other tax and payments to the state budget	(162 987)	(115 190)
Cash flows related to insurance policies	(15 315)	(15 298)
Other cash flows from operating activities	33 193	18 392
Net cash flow from continuing operations	458 077	250 683
Net cash flows from discontinued operations	-	(9 517)
<b>Net cash flows from operating activity</b>	<b>458 077</b>	<b>241 166</b>
<b>Investing activity</b>		
Acquisition of property, plant and equipment	(85 091)	(96 858)
Proceeds from sale of property, plant, and equipment	3 227	14
Proceeds from loans	2 200	2 150
Interest received	364	422
Dividends received	991	1 028
<b>Net cash flows from investing activity</b>	<b>(78 309)</b>	<b>(93 244)</b>
<b>Financing activity</b>		
Repayments of loans	(38 872)	(42 784)
Interest paid	(1 855)	(2 334)
Dividends paid	(276 613)	(611)
<b>Net cash flows from financing activity</b>	<b>(317 340)</b>	<b>(45 729)</b>
<b>Net change in cash and cash equivalents</b>	<b>62 428</b>	<b>102 193</b>
Cash and cash equivalents at the beginning of the year	178 211	76 018
Effect of IFRS 9	(914)	-
<b>Cash and cash equivalents at the end of the year</b>	<b>239 725</b>	<b>178 211</b>



# INTERNATIONAL COOPERATION



The active participation of Kozloduy NPP specialists in the work of leading European and world organisations and forums such as the World Association of Nuclear Operators (WANO), the International Atomic Energy Agency (IAEA), the European Nuclear Society Euratom, the European Nuclear Forum FORATOM and others, provides an excellent opportunity to

conduct an open information policy and interact with nuclear experts from around the world to exchange experience and fruitful collaboration. Thus, the Bulgarian nuclear power plant experts not only apply leading practices in the nuclear industry field, but are also actively involved in their development.

## MISSIONS AT KOZLODUY NPP

In June last year, one of the most important international IAEA reviews – a pre-SALTO (Safety Aspects of Long Term Operation) mission to the plant, was held at Unit 6. During the review covering five areas, a team of IAEA experts examined the long-term operation activities, including those related to ageing management of Unit 6 structures, systems and components important to safety, which are at different stages of implementation – completed, in the process of implementation or planned for implementation.

At the invitation of the Ministry of Energy of the Republic of Bulgaria, from 10 to 20 June 2018, in Sofia, the ARTEMIS Mission of the IAEA was held for review of the Bulgarian

policy for management of spent nuclear fuel and radioactive waste which also covered Kozloduy NPP. The main purpose was for the review team to provide independent expert opinions in the areas under review based on the IAEA safety standards and technical guidelines as well as good international practices.

## HOSTING INTERNATIONAL EVENTS

In pursuance of the 2018 Kozloduy NPP work plan, a series of events with WANO – Moscow Centre (MC) partners took place in which plant specialists actively participated as organisers and participants: Support Mission on the topic of “Using procedures for recurrent repairs” (9 – 11 July); Support Mission on the topic of “Approaches to operators’ training” (3 – 6 December); International Seminar attended by nuclear power plant specialists from the Czech Republic, Hungary, Ukraine, Russia, representatives of WANO and the Nuclear Regulatory Agency on the topic of “Managing beyond design basis accidents at NPPs, including provision of emergency water supply to the primary circuit of WWER reactors by mobile means in extreme situations” (13 – 15 March).

Kozloduy NPP hosted two international benchmarking meetings. The first one, which took place from 25<sup>th</sup> to 27<sup>th</sup> of July with representatives of NNEGC “Energoatom” – Ukraine, Zaporozhye and Khmelnytskyi NPP, was dedicated to the topic “Control and management of the primary operational documentation – safety regulations, instructions for operation of nuclear facilities, regulations for inspections of systems important to safety, etc.” The second meeting on “Deterministic methods of assessment” was held from 5 to 8 November, with representatives of the Czech Temelin NPP and Dukovany NPP.

From 9 to 12 October, a seminar was held at the Bulgarian NPP

organised by the IAEA in connection with the forthcoming SALTO 2020 review mission on Human Resources, Management of Competences and Knowledge for Long-Term Operation.



## PARTICIPATION IN REVIEWS AND FORUMS AT HOME AND ABROAD

In 2018, plant specialists participated in peer reviews of the WANO – Moscow Centre at Robinson NPP, Hartsville (USA), Leningrad NPP (Russia) and South Ukraine NPP (Ukraine), in a support mission at Novovoronezh NPP (Russia), benchmarking workshop at Tianwan NPP (China), and others.

Representatives of the Company were also involved in a number of international and national conferences, seminars, technical meetings and forums in Bulgaria and abroad, including: the first thematic peer review seminar organised by the European Commission on “Ageing management of nuclear reactors” (Luxembourg, 12 – 19 May); the jubilee tenth international forum ATOMEXPO 2018 (Sochi, Russia, 13 – 16 May); the 11<sup>th</sup> International Scientific and Technical Conference on “Safety, Efficiency and Economics of Nuclear Energy” (Moscow, Russia, 22 – 25 May); International Conference of the Bulgarian Atomic Forum – BULATOM (Riviera club, 6 – 8 June); IAEA course on licensing, preparation for construction and supervision of new and expanding nuclear programmes (Ulsan, South Korea, 16 June – 8 July); WANO international working meeting on “Lifetime Characteristics Management of Nuclear Power Plant Equipment” (Ostrovets, Belarus, 25 – 29 June); Annual Conference of the Bulgarian Nuclear Society

(Sveti Vlas, 10 – 13 September).



# HUMAN RESOURCES MANAGEMENT



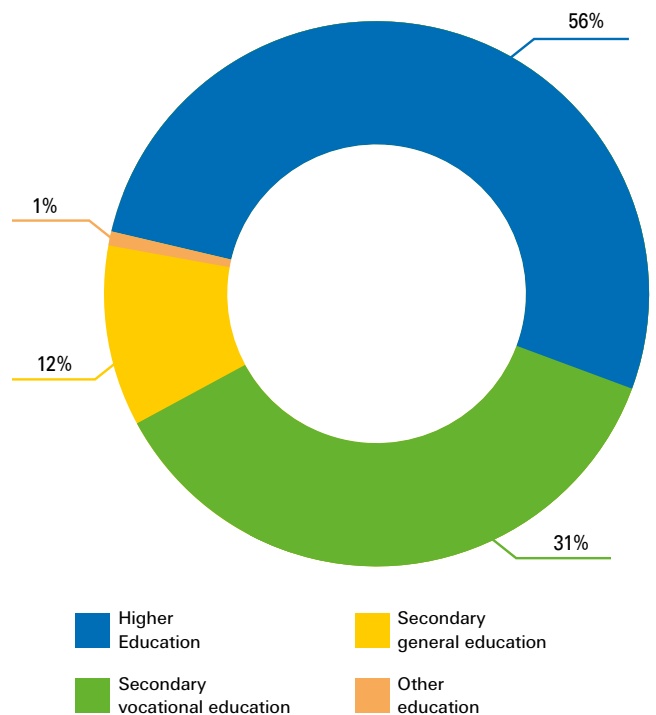
## PERSONNEL PROFILE

Provision of sufficient staffing numbers with the necessary qualification is a condition necessary for ensuring the safe operation of the power units. The priorities in this area are set out in the Human Resource Management Policy and include maintaining and developing the system of professional recruitment, providing opportunities for professional development, systematic training and qualification enhancement, and management of the accumulated knowledge.

In the reporting year, 193 employees joined the plant team, 28% of whom are under the age of 30, and 52% are university graduates. Of those newly-appointed, 41% were assigned to the main production departments as operators, reactor operator engineers, physicists, chemists, designers, power engineers, maintenance engineers, mechanical engineers and others.

More than half of the plant personnel hold university degrees, while one third have graduated secondary vocational schools. The Company guarantees equal rights and opportunities for work, development and career growth, depending on the professional qualification, experience, initiative, personal qualities and performance results achieved. In the preceding year, 157 employees were transferred to another job position in order to better implement the acquired knowledge and skills, while another 45 received an approval by the employer to study at higher education institutions.

Educational structure of personnel



## PRIORITIES AND FUTURE OUTLOOK

Striving to preserve and accomplish smooth transfer of nuclear knowledge and the requirement to maintain the necessary staffing numbers with the relevant educational degree and competencies in order to ensure the long-term safe operation of the units necessitate consistent measures for attracting young people to work in the Company.

Meetings with students majoring in subjects applicable at the nuclear power plant in various career forums enable young people to get an insight into the conditions for work and development in the field of nuclear energy that the Company offers.

As an expression of its social responsibility to the next generations of technical specialists, in 2018, Kozloduy NPP actively participated in a series of meetings with teachers from the Igor Kurchatov Vocational School of Nuclear Energy – Kozloduy, where it presented the needs for nuclear power engineering personnel.

For the fifth year in a row, the Kozloduy NPP was involved in the European project “Training and Employment for Young People” under the Human Resources Development Operational Programme of the Employment Agency, and in 2018 four of the five programme participants received permanent appointments at the plant. Overall, more than 50 young people have been employed in the Company in the frame of this project.

In the summer of 2018, the 14<sup>th</sup> consecutive Student Internship Programme involved 11 university students. They worked on topics related to the activity and technological features of the processes at various departments of the plant. In the past year, Kozloduy NPP initiated the award of scholarships to students enrolled in Bachelor’s and Master’s programmes regarded as plant priority, at the Sofia University “St. Kliment Ohridski” and the Technical University – Sofia. For the academic year 2018 – 2019, contracts were signed with four students for acquiring qualification in the majors “Thermal Power Engineering and Nuclear Power Engineering” – Bachelor’s degree, and “Nuclear Power Engineering” – Master’s degree; the Company committed to provide them

jobs at the plant after successfully completing their education.



## MAINTAINING HIGH EMPLOYEE MOTIVATION

The degree of motivation of workers, which directly affects the level of their performance at the nuclear power plant, is subject to annual surveys. Data is collected and analysed regarding work environment factors influencing the motivation of employees, thus monitoring the effectiveness of the personnel management strategies applied. In the first quarter of 2018, the results were processed of the pilot study

of motivation using an updated questionnaire addressing a total of 24 working environment factors, and conducted at the end of 2017. The data collected confirm that the plant employees possess a high degree of motivation, and this already established positive trend was maintained throughout 2018.

# PERSONNEL TRAINING



The high requirements for the qualification of nuclear energy employees, based on international and national standards and guiding documents, lie at the core of the Kozloduy NPP training system. The nuclear power plant, through the Personnel and Training Center division, holds a licence issued by the Nuclear Regulatory Agency to provide specialised training for activities in nuclear facilities and activities with sources of ionising radiation.

In accordance with the priority stated in the Company's Management Policy for maintaining licensed, competent and motivated personnel, the training process has the following

objectives: fostering high safety culture level; developing corporate culture in which the qualification is of decisive importance; effective use and management of personal and corporate knowledge; encouraging the acquiring of the necessary knowledge, skills and positive attitude to work; integrated risk management identified in the implementation of training and qualification activities.

## TRAINING METHODS AND CONDITIONS

The plant training process is based on a systematic approach to training which is widely applied in nuclear power plants around the world, on the recommendation of the IAEA and national surveillance authorities, including the NRA. Programmes are developed for initial or continuing training; individual programmes are developed for the licensed personnel; the rest of the personnel is trained in accordance with approved curricula. The same requirements apply to the preparation of both workers of the plant and of external organisations performing activities on the site.

Specialised training in various forms (classroom, simulator, practical, hands-on and on-the-job training) takes place both in the Training Center and at the workplaces. The Center has well-maintained facilities – classrooms equipped with modern teaching aids, a mockup room, workshops for vocational instruction using realistic machinery. The ESTRA-based distance learning platform is gaining increasing popularity due to its flexibility and accessibility. It is used by plant and

subcontractors' personnel. In 2018, more than 4000 training sessions of employees of the plant and external companies were conducted in Bulgarian, Russian and English.

The initial and continuing training of operational personnel performing functions related to ensuring and control of nuclear safety uses the full scale simulator (FSS-1000) for WWER-1000 reactor units. The simulator is upgraded to match the current state of the reference Unit 6. To this effect, last year, 43 of the technical solutions executed on the power unit were also introduced in the simulator configuration. In 2018, the training activities included: an initial simulator training for various positions; continuing training of Units 5 and 6 MCR operator crews (8 scenarios in the spring and 8 in the autumn semesters); extra-schedular training sessions; a general emergency exercise; training of FSS-1000 trainers; and, verification and validation of symptom-based emergency procedures.

On-the-job training for the year lasted 11 243 hours, delivered

by more than 320 lecturers and instructors on topics related to the immediate operational and maintenance work of the personnel. Throughout the year, trainings, internships and professional practice terms were organised and carried out for 14 students from different study courses and programmes of the Technical University – Sofia.



## INTERNATIONAL PROJECTS

In 2018, the second stage of the CORONA project “Enhancement of training capabilities in WWER technology through establishment of WWER training academy” was completed. After its completion, in order to ensure the sustainability of the results achieved, the Project Steering Committee approved the signing of a memorandum of understanding allowing the results to be disseminated to members and other service users of the European Nuclear Education Network, ENEN.

In pursuance of a longstanding partnership with universities from Belarus, in 2018, 25 students and lecturers underwent hands-on training at the Training Center of Kozloduy NPP. The international cooperation in the field of training was extended with a 10-day scientific visit of two experts from the Belarusian NPP.

Over the years, the growing interest of various foreign organisations to work jointly with the Training Center team confirms its high competence and the excellent level of professional training in the Bulgarian nuclear power plant.



# PUBLIC RELATIONS



Kozloduy NPP has been following a long-standing policy of open and transparent communication, in response to the need of maintaining a constructive dialogue with the public. All aspects of the Company's activity such as production, safe operation, ecological role, social activities, etc. are publicly presented.

## COMMUNICATION WITHIN THE COMPANY

Believing that successful internal communication lies at the core of effective work and gives personal satisfaction, Kozloduy NPP pays special attention to the communication activities oriented towards the employees of the Company. A number of communication approaches are used, such as the plant intranet, the system of digital displays installed in some of the main building hallways on site, information boards, printouts, the "NPP News" radio broadcast, and others. Especially important is the possibility of feedback and obtaining a precise snapshot of the position of the personnel on various issues. For this purpose, the intranet sections "Question of the week" and "Opinions" are used, as well as opinion-boxes collecting proposals and recommendations written in form sheets specially prepared for the purpose. In 2018, 43% of the opinions posted in the Opinions section contained specific suggestions.





## PUBLIC OUTREACH

The company uses a series of established communication tools to distribute accurate and timely information on its activity and to promote nuclear energy as a safe, secure and environmentally friendly source of electricity. The messages are addressed to the general public as well as to individual groups - the population in the region around the nuclear power plant, representatives of non-governmental organisations and the scientific community, professional partners, young people, etc.

The corporate website, visited over 400 000 times in 2018, offers information on Kozloduy NPP management policies, current data on electricity generation (in real time), news, notifications (for public procurement, tenders and vacancies), information on safe operation, environmental monitoring, emergency preparedness, environmental assessments, etc., as well as a section dedicated to the youngest.

Bulgarian and foreign citizens willing to form their own idea about the operation of the nuclear power plant can pay group or individual visits to the site. In 2018, the NPP's visitors were

nearly 1700, with 74% of them university and secondary school students.

The local, national and global mass media regularly receive briefings or answers to questions on various topics – operation, production and financial results of the Company, implementation progress on the project for lifetime extension of Units 5 and 6, charity initiatives, social activities and many more. The greatest media attention in the preceding year was focused on the official issuance of the package of documents justifying the possibility of extending the operational life of Kozloduy NPP Unit 6 to 60 years, which took place on 25 July, 2018.



# TABLE OF CONTENTS

○ <b>PRODUCTION AND MAINTENANCE PROGRAMMES IMPLEMENTATION</b>	<b>2</b>
OPERATION MODES .....	2
ELECTRICITY GENERATION AND SALES .....	3
SPECIFIC PERFORMANCE INDICATORS .....	4
MAINTENANCE PROGRAMME .....	5
○ <b>SAFETY</b>	<b>6</b>
LICENSING REGIME .....	6
SAFETY CULTURE .....	7
NUCLEAR SAFETY .....	8
RADIATION PROTECTION .....	8
RADIATION MONITORING OF EMISSIONS DISCHARGED TO THE ENVIRONMENT .....	9
RADIOACTIVE WASTE MANAGEMENT .....	9
SPENT NUCLEAR FUEL MANAGEMENT .....	10
EMERGENCY PLANNING AND PREPAREDNESS .....	10
PHYSICAL PROTECTION .....	11
FIRE SAFETY .....	11
RADIOECOLOGICAL MONITORING .....	12
PUBLIC DOSE EXPOSURE EVALUATION .....	13
ENSURING OCCUPATIONAL HEALTH AND SAFETY .....	14
ENVIRONMENTAL MANAGEMENT .....	15
○ <b>IMPLEMENTATION OF THE PROJECT FOR LIFETIME EXTENSION OF UNITS 5 AND 6 AT KOZLODUY NPP</b>	<b>16</b>
ACTIVITIES COMPLETED ON UNIT 5 .....	17
ACTIVITIES COMPLETED ON UNIT 6 .....	17
○ <b>INVESTMENT PROGRAMME IMPLEMENTATION</b>	<b>18</b>
○ <b>FINANCIAL PERFORMANCE</b>	<b>19</b>
SEPARATE STATEMENT OF FINANCIAL POSITION .....	21
SEPARATE STATEMENT OF PROFIT OR LOSS AND OTHER COMPREHENSIVE INCOME FOR THE YEAR ENDED 31 DECEMBER .....	22
SEPARATE STATEMENT OF CASH FLOW FOR THE YEAR ENDED 31 DECEMBER .....	23
○ <b>INTERNATIONAL COOPERATION</b>	<b>24</b>
MISSIONS HELD AT KOZLODUY NPP .....	24
HOSTING INTERNATIONAL EVENTS .....	25
PARTICIPATION IN REVIEWS AND FORUMS AT HOME AND ABROAD .....	25
○ <b>HUMAN RESOURCES MANAGEMENT</b>	<b>26</b>
PERSONNEL PROFILE .....	26
PRIORITIES AND FUTURE OUTLOOK .....	27
MAINTAINING HIGH EMPLOYEE MOTIVATION .....	27
○ <b>PERSONNEL TRAINING</b>	<b>28</b>
TRAINING METHODS AND CONDITIONS .....	28
INTERNATIONAL PROJECTS .....	29
○ <b>PUBLIC RELATIONS</b>	<b>30</b>
COMMUNICATION WITHIN THE COMPANY .....	30
PUBLIC OUTREACH .....	31





Kozloduy NPP EAD  
3321 Kozloduy  
tel.: + 359 973 7 20 20  
Fax: + 359 973 8 05 91  
e-mail: info@npp.bg

**[www.kznpp.org](http://www.kznpp.org)**