ELECTRICITY
SYSTEM OPERATOR EAD

Annual Report 2007

ESO EAD

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Board of Directors of the Electricity System Operator EAD

Valentina Hristova
Chairman

Ivan Ayolov
Executive Director

Mitiu Hristozov
Member of the Board

Ladies and Gentlemen,

The activities of Electricity System Operator EAD (ESO EAD) in 2007 were marked by Its establishment as a new administrative and managerial structure within the Bulgarian electric power system, in line with the EU requirements. Providing independence of ESO EAD stood as one of the EU conditions for development of the Bulgarian electricity market in a free market economy environment.

Last year's overall objectives of ESO EAD were focused on running the common operational planning, coordination and control of the Bulgarian power system, carrying out transit of electricity via the national grid, ensuring its interconnected operation with other countries' power systems, as well as operation and maintenance of the transmission network.

When it comes to domestic electricity market organisation and development, one should not fall short to consider the role of ESO EAD. In 2007 the market underwent a significant change in terms of transparency and equal access. The competitive approach to transmission capacities reallocation tenders for electric trade, along with the precise rules in force since August last year, showed the business community that each trader who covers the electricity market participation criteria will be given an equal chance.

The successful implementation of our tasks set for 2007 turned ESO EAD into a major guarantor for reliable power supply nationwide.

Since September 2007, ESO EAD has been a full member of the European Transmission System Operators, ETSO. Our active involvement in various projects as part of another oganisation, UCTE, enabled ESO EAD to host the 39th regular meeting of the UCTE Steering Committee.

The Annual Report 2007 comprises the most relevant elements of ESO EAD's activity and not only indicates the outcomes achieved but also defines steps to be taken to ensure secure electric power system operation in a generation pattern that has changed considerably after the decommissioning of units 3 and 4 of NPP Kozloduy and unit 2 of TPP Bobov Dol.

Smooth organisation in place, devoted and highly skilled performance of our employees: these are the cornerstones that reinforce both the company's national and European positions and Bulgaria's image as an energy centre of the Balkans.

Ivan Ayolov
Executive Director

Background, Establishment and Formation

The Electricity System Operator EAD (ЕСО ЕАД) is a sole joint stock company registered with Sofia City Court's decision No 1 of 4.01.2007, company case No 16298/2006, and incorporated into the Trade Register under lot 112765, volume 1528, register 1, page 53.

Headquarters and main office address: 51 James Bourchier blvd, 1407 Sofia, Bulgaria. ESO EAD is established for an indefinite period under UIC 175201304 and by virtue of the VAT Act.

Sole owner of the capital: National Electricity Company EAD (NEK EAD).

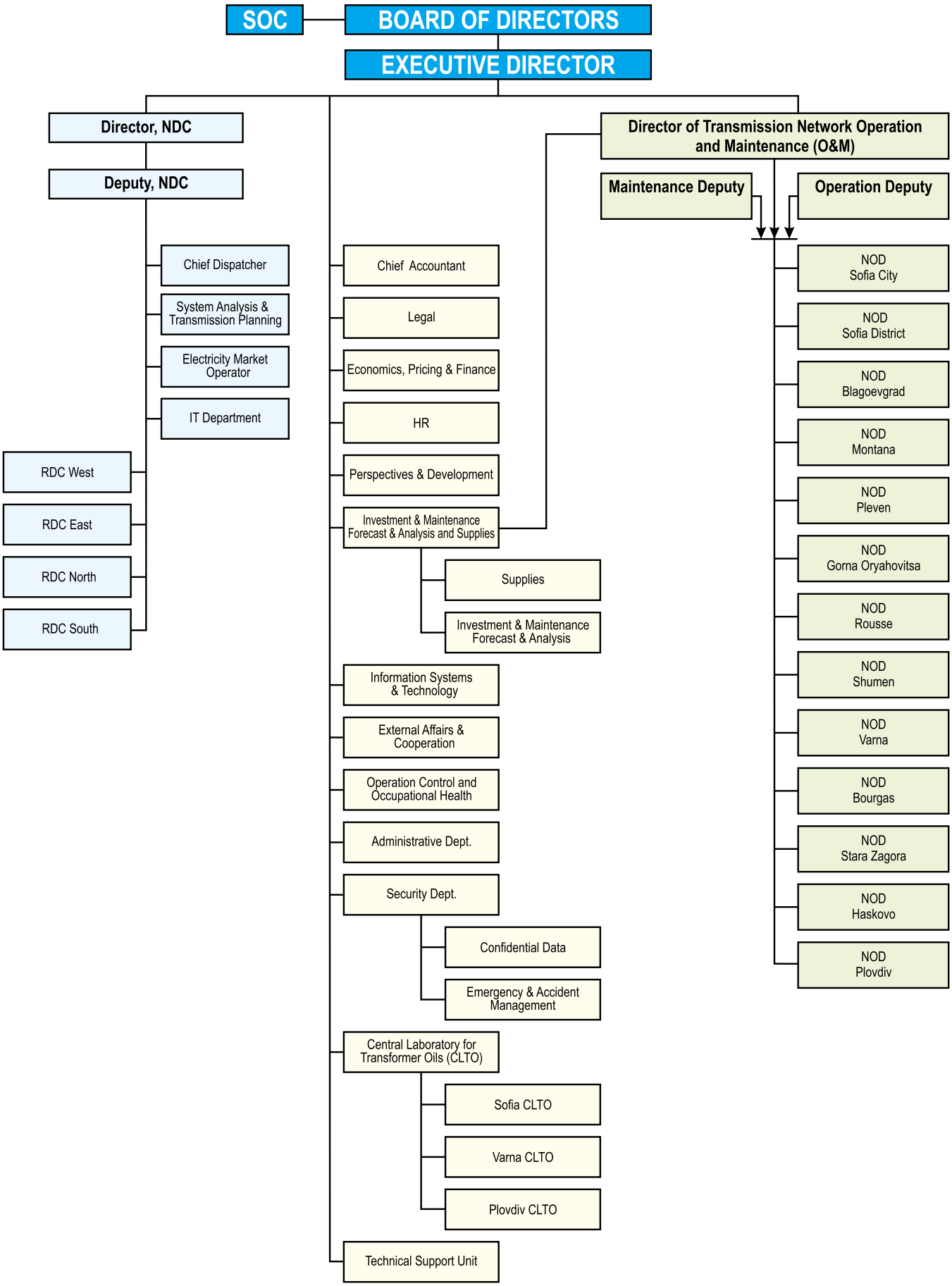
Company's capital: stands at 57 847 195 BGN allocated in nominal shares with face value of 1 BGN each. The capital is paid up by NEK EAD through contribution in kind: immovable property and assets of equal value.

The main priorities in ESO EAD's activity focus on carrying out its obligations as set forth by the Energy Law pertinent to electricity system control, electric energy balance and exchange market administering as well as transmission network operation and maintenance, in accordance with a contract concluded with the National Electricity Company EAD.

Among the major tasks of ESO EAD is to ensure security of the domestic power supply and reliability of the electric power system in a substantially modified generation pattern due to the shutdown of units 3 and 4 of NPP Kozloduy.

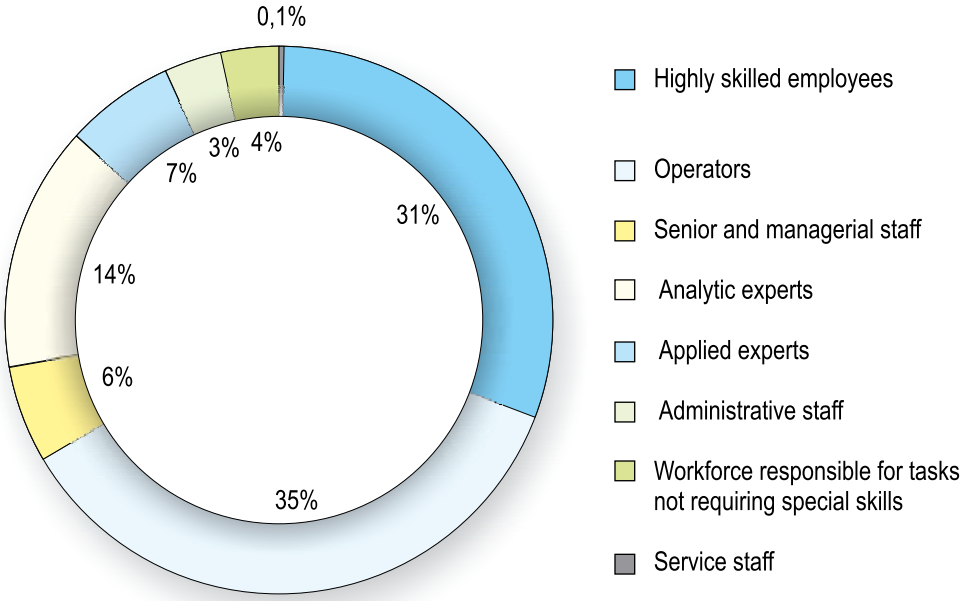
ELECTRICITY SYSTEM OPERATOR EAD

ORGANISATION STRUCTURE



Number and Expertise Level of Staff

The staff of ESO EAD as endorsed by the NEK EAD Board of Directors at the setup of the company numbers 3 962 persons split up into groups according to the National Classification of Professions and Positions:



Field of Action

ESO EAD is primarily involved in operating the EPS. The company has been issued a license under Decision No P-052/28.12.2006 by the State Commission of Energy and Water Regulation /SCEWR/ for a period of 35 years.

The main tasks of EAD include:

- Power system operational control
- Administering of the electrical energy
- Power system operation and maintenance under contract with NEK EAD.

The National Dispatching Center Guarantees the Secure Operation of the Electrical Power System

The Electricity System Operator (ESO) EAD National Dispatching Center (NDC), being the operator of the electrical power system of the Republic of Bulgaria, provides centralized operational management, control and coordination of the electrical power system operational regimes. The NDC main task for 2007 was the secure and efficient operation of the electrical power system in a stable synergy with the electrical power systems of the European countries from the synchronous UCTE zone. The NDC with its branches, the Regional Dispatching Centers (RDCs) carries out constant operational control of the electrical power system, always keeping the balance between electricity generation and demand in the country and the planned power exchanges with the electrical power systems of the neighboring countries.

The NDC organizes and administrates the electricity market and the balancing power market as an inseparable part of the applicable market model.

On October 1st, 2007 ESO carried out a tender procedure for allocation of the available capacity over the transmission interconnections of Bulgaria with Greece, Romania and Serbia among companies, providing their stakeholders with commercial transmission rights (CTRs) for electricity export and import. Auctions were carried out for receiving electricity cross-border CTRs on annual and monthly basis.

The NDC ensures the technical conditions and the implementation of the planned schedules for transmission of the electricity quantities agreed between the power market participants.

In adition to this, in 2007 the market for electrical power import and export transactions was liberalized. The market participants have exported 4,5 billion kWh of electricity.

Electrical Power Balance for 2007

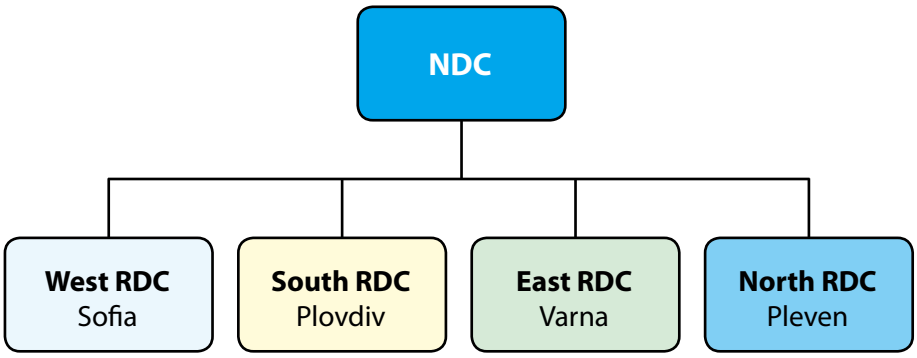
Consumption in the country	38,559 TWh
Export	4,534 TWh
NPP Generation	14,641 TWh
TPP Generation	25,304 TWh
HPP Generation	3,148 TWh
Total Generation	43,093 GWh

Some of the most important activities and projects carried out in 2007 by the NDC Direction are the following:

• Improvement of the functionality of the electricity market administration system;

• Supply of a New system – a specialized software and hardware for the ESO operation under liberalized market conditions.

There are four Regional Dispatching Centers operating on the territory of Bulgaria.



Functional Structure of the Operational Control in the Bulgarian Electrical Power System

The operational control in the distribution network is provided by the District Dispatching Services in the Electricity Distribution Companies. The District Dispatching Services and the dispatching companies operating on equal basis carry out the control over the respective distribution networks either directly or by the operational staff on shift at: HV/MV substations, producers and consumers connected to the distribution network, and maintenance squads.

National Dispatching Center

Director: Mitiu Hristozov
Deputy: Bozhidar Pavlov

Territorial Dispatching Center – West

Sofia

Head: Elena Tsoleva

Territorial Dispatching Center – South

Plovdiv

Head: Marin Nikolov

Territorial Dispatching Center – East

Varna

Head: Varban Kondov

Territorial Dispatching Center – North

Pleven

Head: Dimitar Voutov

Operational Control of the Power System

NDC (the National Dispatching Center) organizes the provision of system services to the transmission network users, i.e.:

- Operational control of the EPS, including:
  - frequency and power exchange control;
  - voltage and reactive power control;
  - tripping operations to modify grid patterns;
  - coordination of the interconnected mode operation between the power systems of Bulgaria and UCTE.
- Emergency control operation;
- Recover the stability of interconnected operation after system failures;
- Provide equal access for the transmission system users in conformity with the relevant quality requirements;
- Administer both the electrical energy transactions concluded on regulated and freely negotiated prices, and the balancing energy market.

To deliver the system services as described above, NDC arranges purchasing and free use of the following additional services provided by the transmission network clients:

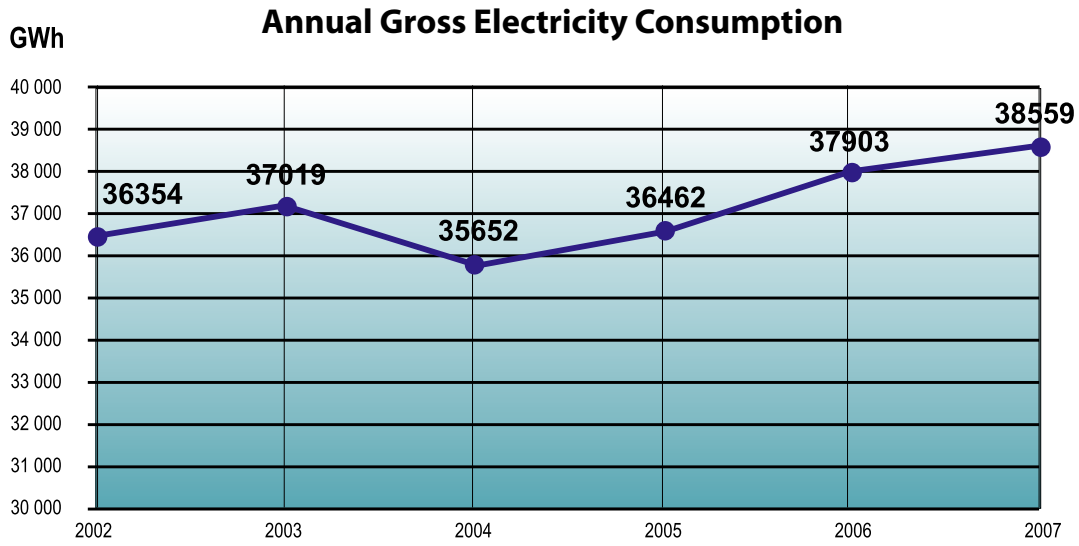
- Primary frequency control reserve;

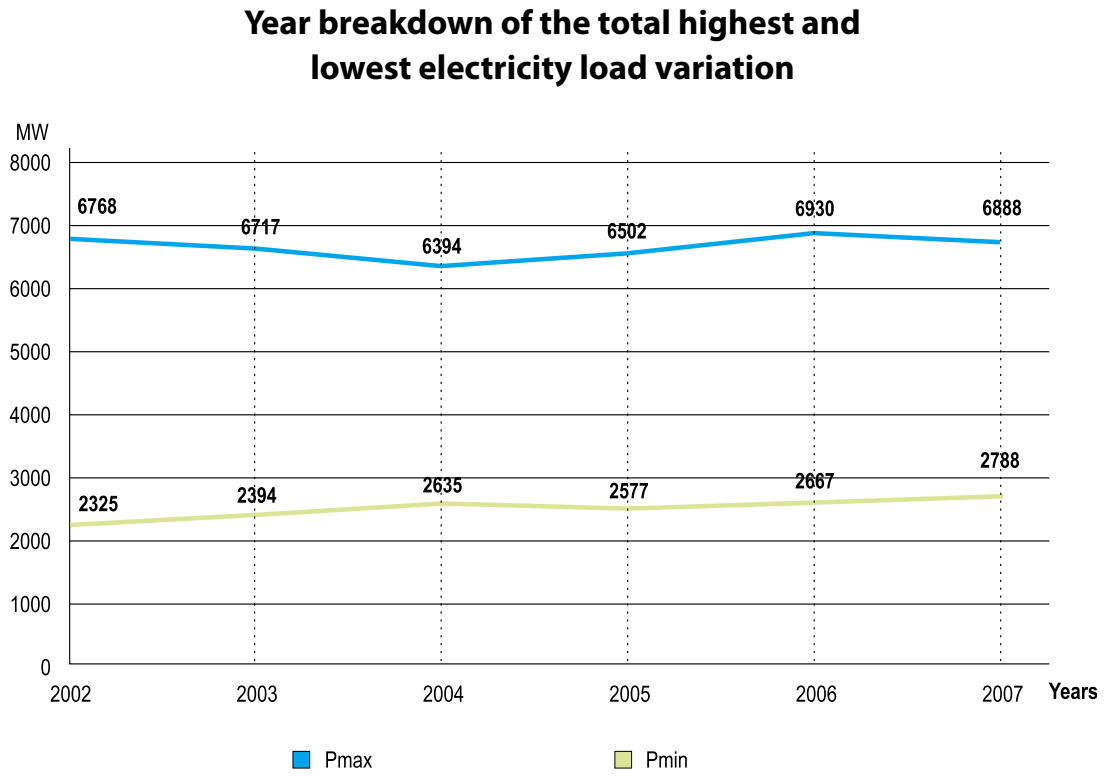
- Secondary frequency and power exchange control;
- Rotating and 'cold' tertiary control reserve;
- Available reactive power control range for network voltage control;
- Network user participation in the Defence Plan and the Emergency System Recovery Plan.

Electrical Power System of the Republic of Bulgaria

Electricity Consumption

Since 2004, there has been a constant rising trend in the country's electric power consumption.





Generation Capacities

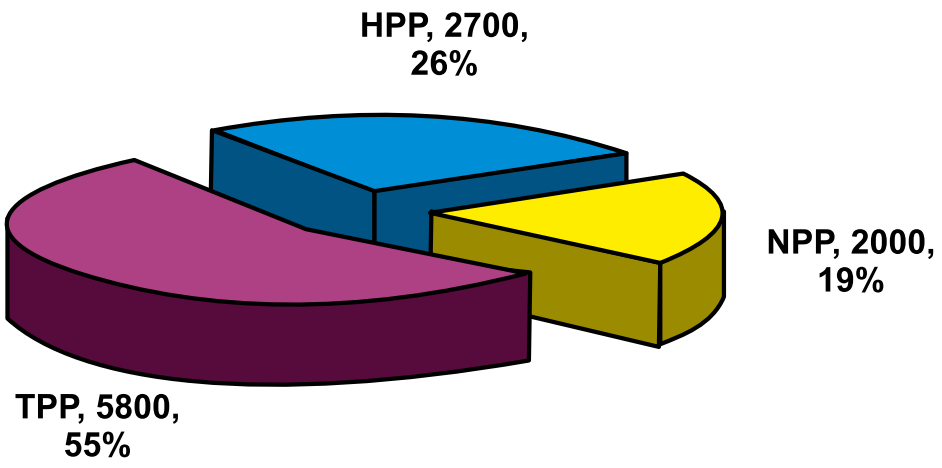
Electricity generation is based on two major pillars:

- Production by the thermal power plants fueled by local lignite;
- Production by the nuclear power plant.

Generation capacities installed in the power plants

NPP	**2000 MW**
TPP	**5800 MW**
Lignite	2400 MW
Black and brown coals	2600 MW
Gas	500 MW
Mixed fuel	300 MW
HPP	**2700 MW**
Dam-powered	2500 MW
Watter current-powered	200 MW

Installed generation capacity allocation by primary power source, MW, %

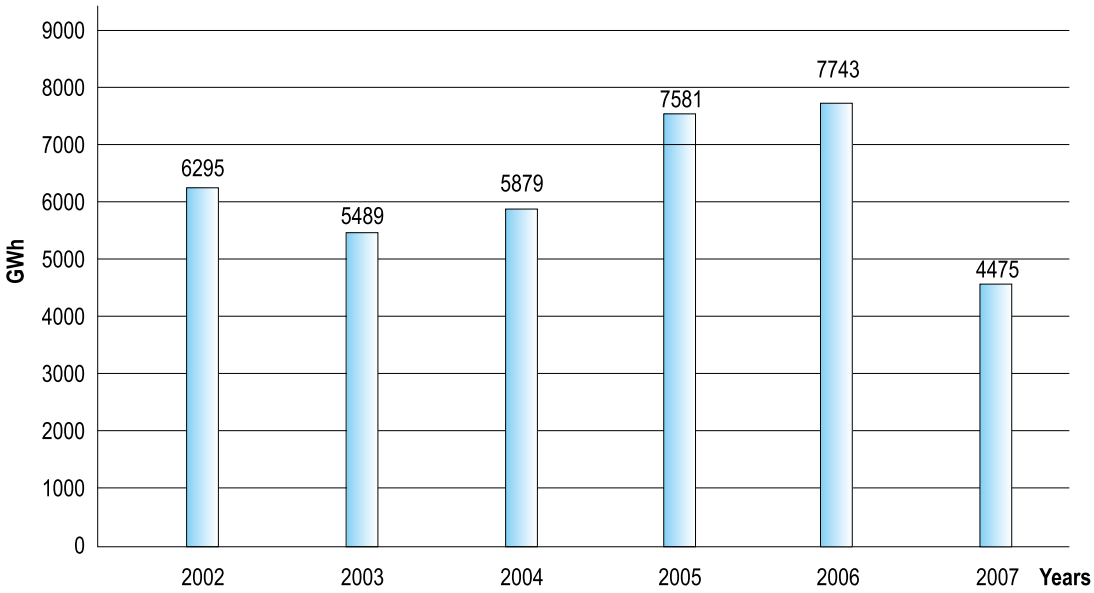


Interconnection Lines

The EPS of Bulgaria is strongly interconnected with the neighbouring countries' EPSs. These tie-lines ensure both reliable interconnected operation within UCTE and the necessary technical conditions for large-scale electricity exchange and participation of our country in the regional electricity market.

Rated voltage, kV	Interconnection line	Neighbouring country	Substation in Bulgaria	Neighbouring substation	Length, km	Interconnected operation w/ UCTE
400 kV	Druzhba	Romania	Dobrudzha	Isaccea	230.6	yes
400 kV	Tantareni1	Romania	Kozloduy	Tantareni	115.7	yes
400 kV	Tantareni 2	Romania	Kozloduy	Tantareni	115.7	yes
400 kV	Nišava	Serbia	Sofia Zapad	Niš	122.6	yes
400 kV	Edirne	Turkey	Maritsa Iztok 3	Babaeski	136.6	no
400 kV	Sakar	Turkey	Maritsa Iztok 3	Hamitabat	150.0	no
400 kV	Pirin	Greece	Blagoevgrad	Thessaloniki	174.7	yes
220 kV	Dunav	Romania	Kozloduy	Isalnita	98.1	no
110 kV	Vrashka Chuka	Serbia	Kula	Zajecar	21.0	no
110 kV	Erma	Serbia	Breznik	Vrla	64.1	no
110 kV	Stratsin	Macedonia	Skakavica	Kriva Palanka	12.7	yes, temporally
110 kV	Belasitsa	Macedonia	Petrich	Susica	49.3	yes, temporally
400 kV		Macedonia	Crvena Mogila	Stip		under construction
400 kV		Greece	Maritsa Iztok 1	Philippi		running project

Annual Electricity Export



The decommissioning of NPP Kozloduy has translated into mover than 40% drop in electricity exports from Bulgaria in 2007 as opposed to 2006.

Administering the Electric Energy Market

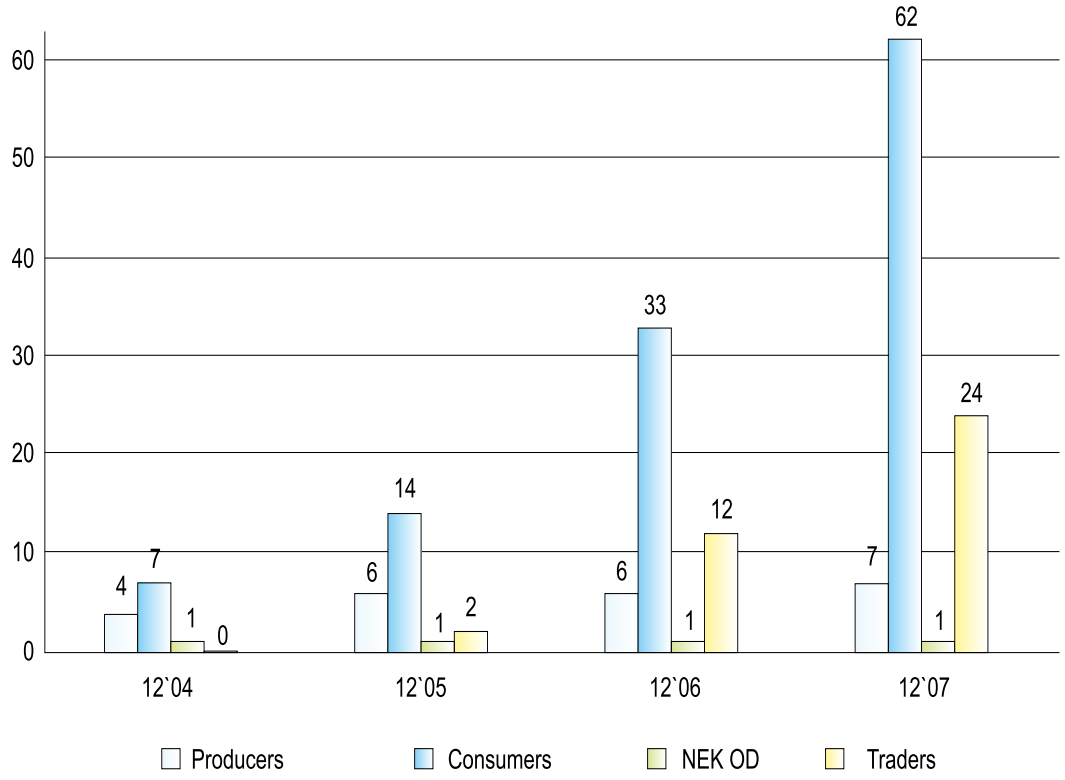
Electric Energy Market

ESO EAD administers the electrical energy transactions, which are based on regulated and freely negotiated prices, and organises the balancing energy market as prescribed by the Rules for trading in electricity.

In 2007, the electricity market marked a nearly 100% rise (compared to 2006) in terms of new trade actors – electric energy consumers and traders as well as considerably increased number of transactions arranged by licensed traders.

The total amount of energy traded at negotiated prices in 2007 is 7 304 886 MWh, as opposed to 4 140 556 MWh in 2006.

Registered Trade Actors



A Market in Limited Transmission Capacity Rights

ESO EAD follows the provisions of Regulation (EC) No 1228/2003 requiring the use of market approaches to congestion management, publication of available transmission capacities and their allocation on an annual, weekly and day ahead/intraday basis in a transparent and nondiscriminatory manner.

ESO EAD developed Rules on Transmission Capacity Allocation at the Tie-Lines between ESO EAD and its neighbouring Control Areas ('the Rules'). These are endorsed by SCEWR and have been applicable since October 2007.

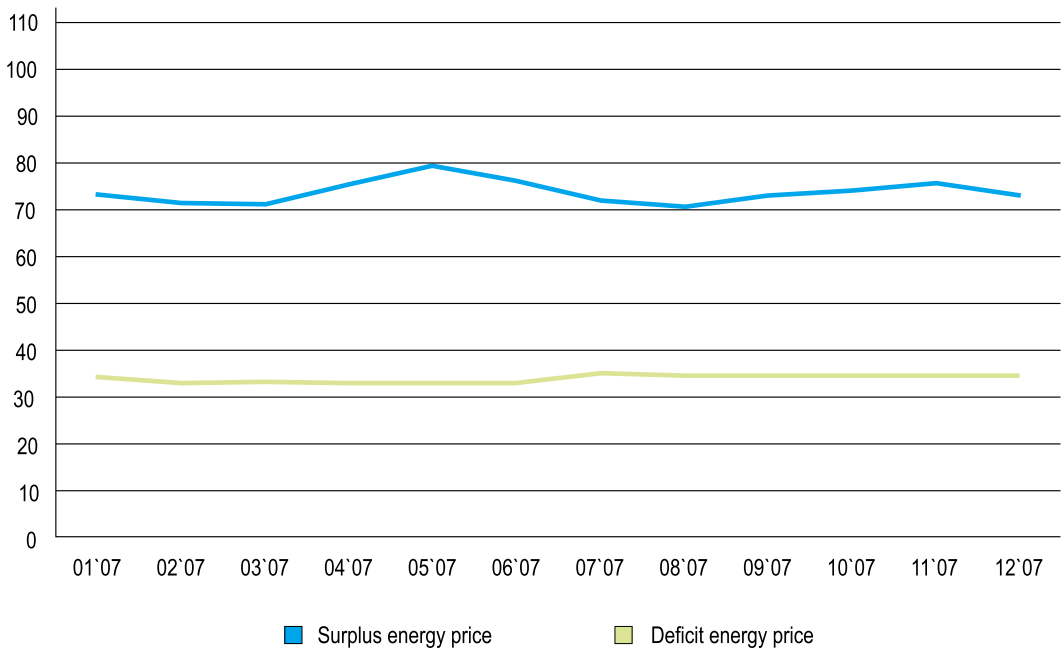
Balancing Energy Market

The trade actors' energy unbalances in 2007 showed a downward trend, despite the still remaining long forecasting period (up to 10 days) and the lack of real opportunities for energy purchase and sale close to the actual day of delivery. The energy needed to cover the power deficit in 2007 amounted to 98 781 MWh or 2.7 % of the registered schedules to end-users, while that for surplus compensation stood at 174 417 MWh or 4.8 % of the registered schedules.

For each settlement period, ESO EAD defines two prices of balancing energy:

Balancing Energy

Price average by months, BGN/MWh



'Cold' Reserve and Auxiliary Services Market

In order to guarantee the security of power supply, ESO EAD buys 'cold' reserve from electricity producers in the form of generation sets made available. The total purchased 'cold' reserve availability equals 9 563 628 MW*h/year, with annual costs totaling 158 172 k BGN.

Costs on 'Cold' Reserve Availability

Power plants	'Cold' reserve availability MW*h/year	Costs on 'cold' reserve, BGN
Bobov Dol	1209656	12672845
Rousse	362437	2876037
Varna	3814301	30875590
Maritsa Iztok 2	1396477	33556883
Maritsa Iztok 3	757246	33277837
Maritsa 3	64904	844402
HPP-NEK	1958607	44068641
TOTAL	**9563628**	**158172235**

To ensure operational security, ESO EAD concludes auxiliary service contracts with generation companies at freely negotiated prices. The total purchased availability for auxiliary services amounts to 1 013 797 MW*h/year, with annual costs totaling 9 063 k BGN.

Costs on Auxiliary Service Availability

Power plants	Auxiliary service availability MW*h/year	Costs on auxiliary services, BGN
Bobov Dol	330712	3404303
Rousse	13037	105996
Varna	641317	5218507
Maritsa Iztok 2	0	0
Maritsa Iztok 3	0	0
Maritsa 3	28731	334140
TOTAL	**1013797**	**9062946**

Transmission Network Operation and Maintenance (TNOM)

Director: Stiliyan Tcheshmedzhiev
Maintenance Deputy: Rumen Peshev
Operation Deputy: Angel Sotirov

The TNOM Division is in charge of the transmission network operation and maintenance activities as set forth in the Contract on TN operation and maintenance concluded between NEK EAD and ESO EAD.

The main tasks of TNOR include:

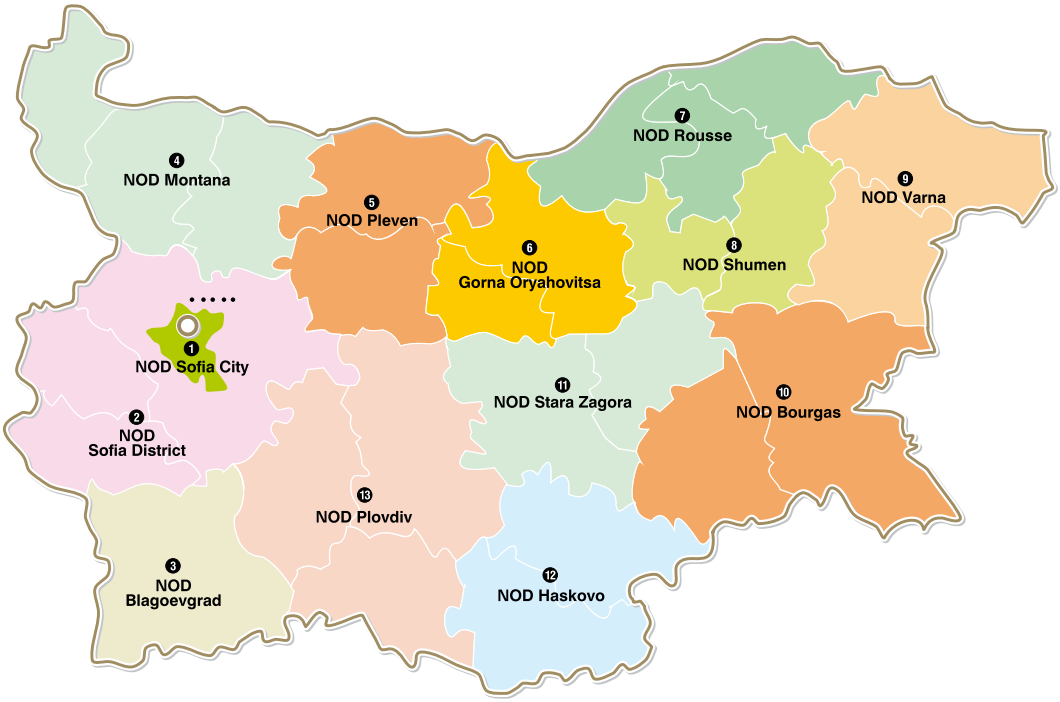
- current repair and maintenance of OHLs and HV / MV installations at substations;
- repetitive technical control of the facilities ;
- electrical measurements and diagnostics of HV and MV facilities;
- provision of occupational health and safety as well as fire protection.

ESO EAD maintains power transmission lines with a total length of 14 152 km, including OHLs 750 кV - 85 km, 400 кV - 2 257 km, 220 кV - 2 792 km, and 110 кV - 9 018 km.

ESO EAD maintains 290 electrical substations, including: one s/s 750/400кV, six s/s 400/ 220/110кV , seven s/s 400/110кV, one hub s/s 400кV, eighteen s/s 220/110кV, and 257 s/s 110kV/ MV.

ESO EAD

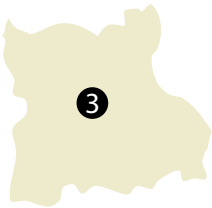
Network Operation Districts (NODs)



❶ NOD Sofia City
Head - Chavdar Gerov
Substations - 15
OHLs - 389.8 km

❷ NOD Sofia District
Head - Dimitar Dimitrov
Substations - 29
OHLs - 2535.9 km

❸ NOD Blagoevgrad
Head - Vasil Kamburov
Substations - 12
OHLs - 559.7 km

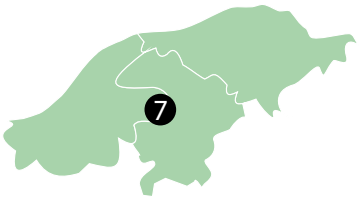


❹ **NOD Montana**
Head - Gavril Gavrilov
Substations - 25
OHLs - 1712.7 km

❺ **NOD Pleven**
Head - Ivan Yotov
Substations - 23
OHLs - 1097.5

❻ **NOD Gorna Oryahovitsa**
Head - Yordan Likomanov
Substations - 16
OHLs - 907.3 km

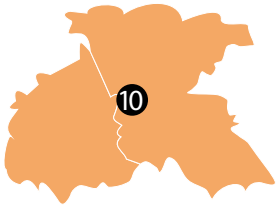
❼ **NOD Rousse**
Head - Emil Kostadinov
Substations - 15
OHLs - 826.9 km



❽ **NOD Shumen**
Head - Diyan Cholakov
Substations - 15
OHLs - 717.9 km

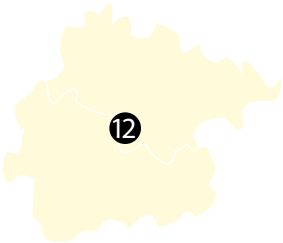
❾ **NOD Varna**
Head - Totyu Bonev
Substations - 22
OHLs - 1151.23 km

⑩ NOD Bourgas
Head - Stoyan Stoyanov
Substations - 30
OHLs - 1302.4 km

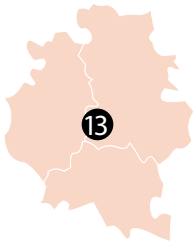


⑪ NOD Stara Zagora
Head - Georgi Simov
Substations - 27
OHLs - 1145.44 km

⑫ NOD Haskovo
Head - Tosho Todorov
Substations - 20;
220/110 kV - 1
OHLs - 1002,4 km



⑬ NOD Plovdiv
Head - Nikola Alimanski
Substations - 40+1 (hub)
OHLs - 1809.3 km



Transmission Network Operation and Maintenance

(Based on a contract with NEK EAD)

Over the reference period, the costs on repair, preventive measures and maintenance of the transmission network sum up to 35 174, 14 k BGN. This figure breaks down to:

- scheduled repairs - 26 806,63 k BGN;
- emergency repairs - 1 228,83 k BGN;
- preventive maintenance - 7 138,68 k BGN.

Overhead Lines (OHLs)

On the expense side, the reference period saw scheduled and emergency repair costs totaling 15 977, 13 k BGN, plus another 4 778,3 k BGN spent on preventive maintenance.

The main repair activities in 2007 include:

- replacement of 855,3 km lightning cables with integrated optic fibres ;
- repair of 52 km OHLs through replacement of towers and conductors;
- replacement of 278 km lightning cables without integrated optic fibres;
- replacement of tensioners on 219 towers;

- replacement of 490 insulation circuits;
- replacement of over 10 000 insulation elements.

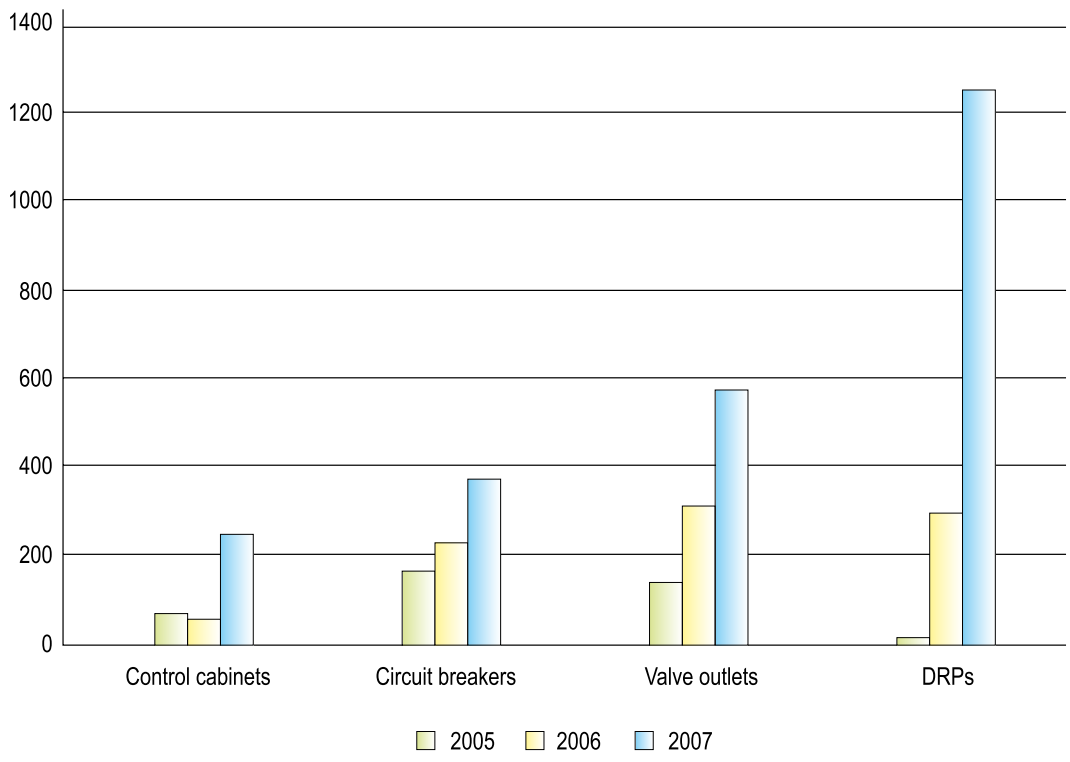
Substations

In the period of reference, the scheduled and emergency substation repair costs amount to 11 789, 89 k BGN, plus a total of 2 260, 22 k BGN on preventive maintenance.

The main repair activities in 2007 include replacements as follows:

- 372 MV circuit breakers;
- 907 MV current transformers;
- 822 MV voltage transformers;
- 1 585 MV и 534 HV valve outlets;
- 916 MV and 297 HV digital relay protections (DRPs);
- 50 ohmic resistances;
- 141 automatic voltage regulators;
- 226 control cabinets;
- 26 accumulator batteries and charger units.

A comparison among those facilities that have been replaced in 2005, 2006 and 2007 and constitute the greatest proportion per total volume is shown on the following histogram:



Fault Rate Analysis

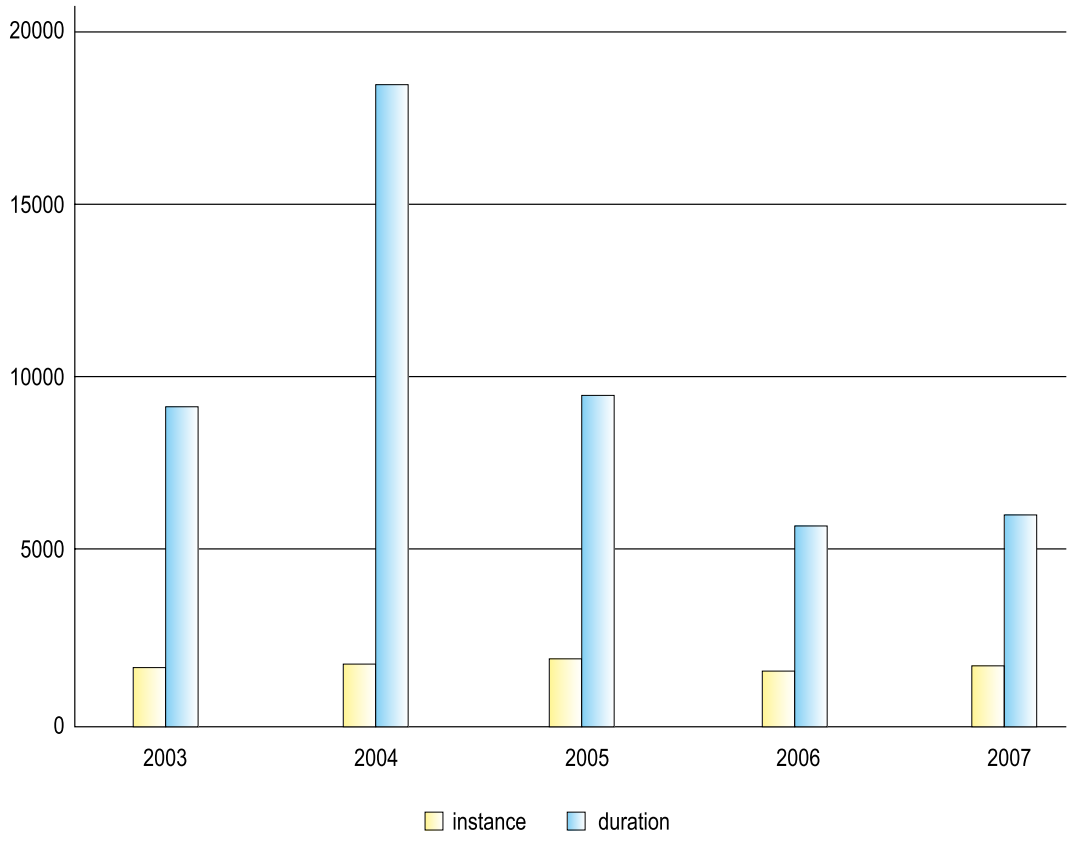
All in all, the number of automatic and manual tripping occurrences for 2007 is 1492 with a total duration of 5900 hours, including:

- 1416 automatic tripping instances with a continuance of 4002 hours.
- 76 manual tripping instances with a continuance of 1898 hours.

The number and duration of automatic and manual tripping instances in 2007 were relatively similar to those in 2006, but have dropped significantly as compared to the preceding 2003 – 2005 timeframe.

This lower fault rate is due to the high quality repair works and preventive maintenance done on the transmission network.

Analysis of Tripping Occurrences During the Last 5 Years

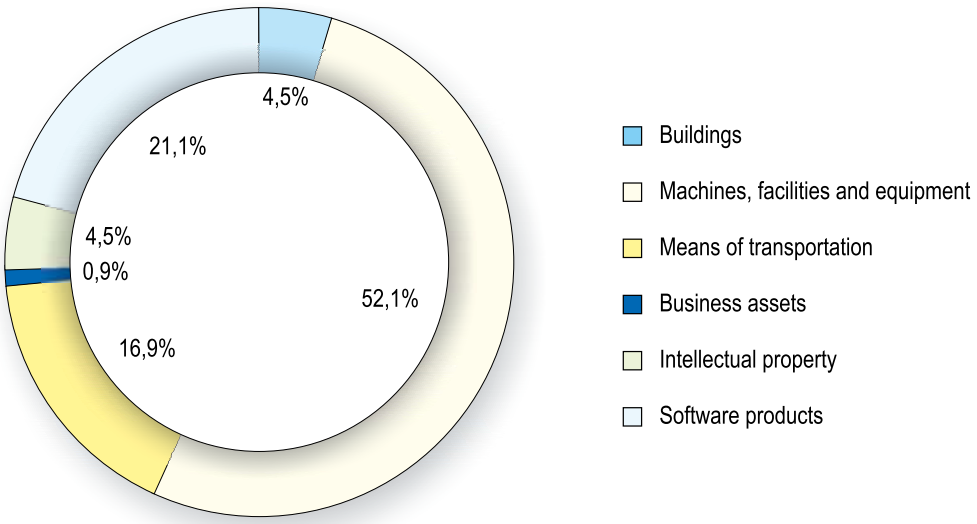


Investment Activity

ESO EAD pursues investment targets as given below:

- Training and expertise upgrade;
- Transmission network maintenance in line with the Contract on TN operation and maintenance between NEK EAD and ESO EAD;
- Optimisation of the power system operational control efficiency and observance of the UCTE synchronous interconnected operation requirements via deployment and commissioning of all pertinent real time control information systems;
- Introduction and operation of reliable technical means to control the transactions concluded in the electricity, balancing energy and cross-border transmission capacity allocation markets.

The investment costs of ESO EAD amount to 11 917, 9 k BGN.



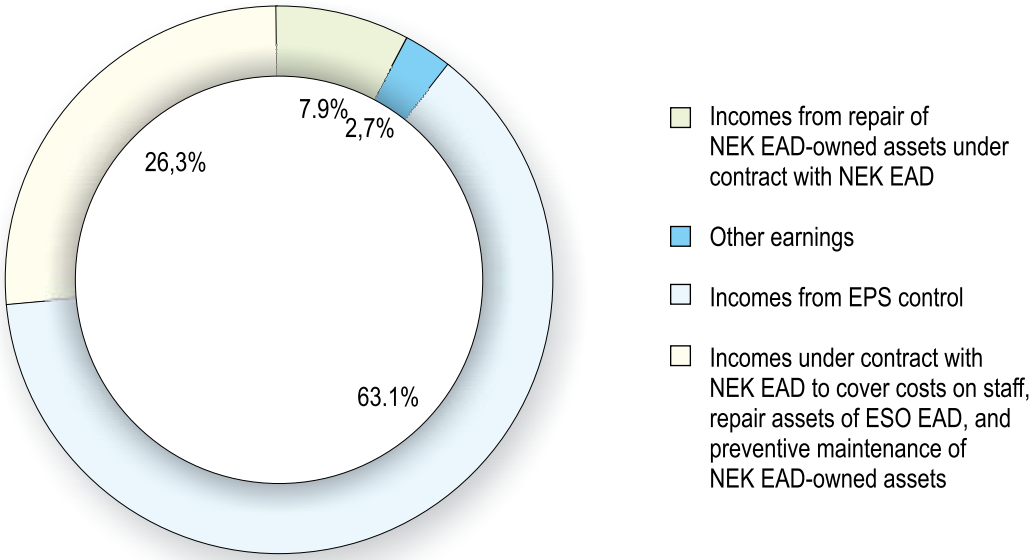
Incomes from Sales

The company's sales revenue stands at 357 432 k BGN. This brakes down to:

- incomes from power system control;
- fixed earnings rate under contract with NEK EAD;
- variable earnings rate under contract with NEK EAD;

Other operative incomes derive from:

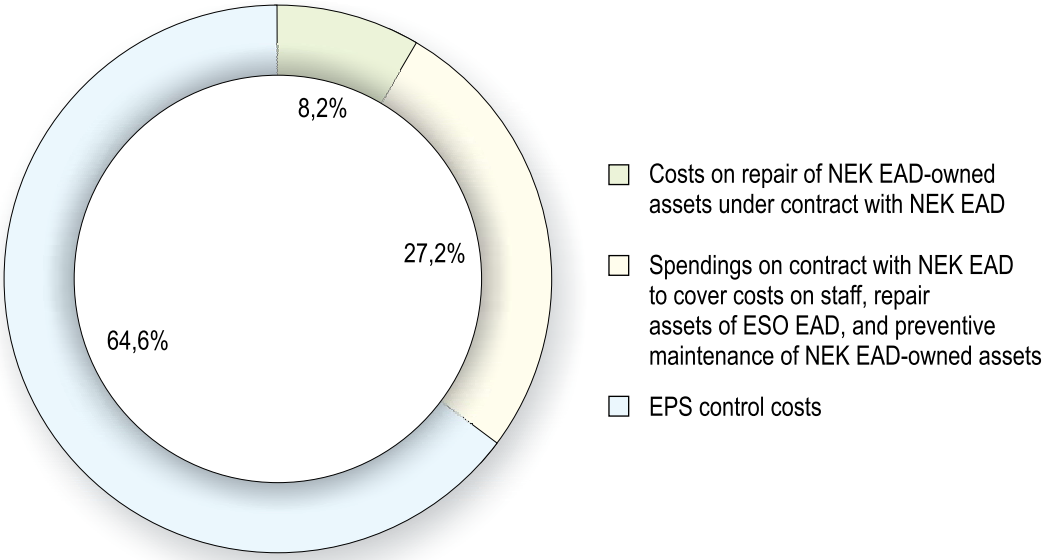
- reactive energy;
- current asset sales;
- default penalties due to non-fulfillment of contract obligations;
- investment in acquisition of long term assets;
- auxiliary activities, loans, insurance compensations and fixed asset sales.



Operative Costs

The company's operative cost balance is 345 309 k BGN, including:

- EPS control costs;
- costs on fixed rate under contract with NEK EAD;
- costs on variable rate under contract with NEK EAD;



Financial Result

The company's cost balance is 345 309 k BGN, including:

- power system control costs;
- costs on fixed rate under contract with NEK EAD;
- costs on variable rate under contract with NEK EAD;

The company's earnings before taxation equal to 10 483 k BGN with net profit of 9 433 k BGN for the reference period.

Gross profit from power system control: 2 365 k BGN.

Gross profit from fixed rate under contract with NEK EAD: 178 k BGN.

Composite Financial Index Analysis

The composite financial index analysis is done based on the 2007 budget calculations and account statement. It indicates a good financial status.

Indices	Budget	Statement
Profitability indices		
Sales income profitability index	0,003	0,027
Equity capital profitability index	0,015	0,162
Profitability index of liabilities	0,035	0,248
Asset capitalization coefficient	0,01	0,098
Efficiency indices		
Cost efficiency rate	1,003	1,035
Income efficiency ration	0,997	0,996
Liquidity indices		
Total liquidity rate	0,799	1,543
Quick liquidity rate	0,516	1,253
Instant liquidity rate	0,516	1,253
Absolute liquidity rate	0,039	0,324
Financial autonomy indices		
Rate of solvency	2,313	1,536
Rate of indebtedness	0,432	0,651
Fixed asset funding rate	0,92	1,332
Current asset funding rate	2,894	1,41

International Contacts and Cooperation

Productive and emblematic. A definition that seamlessly fits the profile of ESO's international contacts during the last year. As a full member of UCTE, ESO coordinates the interconnected operation of the Bulgarian EPS within the synchronous area of the European power systems. Security and quality of the interconnected operation are of highest importance to ESO. Observing these priorities has a direct impact upon the security and quality of power supply to the end consumers. The Electricity System Operator has been working successfully on the development of the national electricity market and its integration at both regional and European levels.

Representatives of ESO EAD participate in the General Assembly and the working meetings of UCTE SC where decisions are made pertaining to the technical standards and quality criteria for interconnected operation, including their implementation and control.

ESO experts are actively involved in the working groups on Security of Interconnected Operation, Development of UCTE, Coordinated Planning, Compliance Monitoring, as well as on the execution of UCTE synchronous area extension projects such as the projects for interconnected operation with the Russian and integration of the Turkish electric power systems.

On 21 September 2007, ESO EAD hosted the 39th Regular Meeting of UCTE in Sofia. Deliberations were primarily focused on the security of interconnected operation as a prerequisite for proper functioning of the free electricity market. The Euro-

pean Commission's package on the set-up of a common European TSO organisation was also discussed.

Since September 2007, ESO EAD has been a full member of the European Transmission System Operators, ETSO. Coordination and development of mutually beneficial rules for compensation of the losses that TSOs bear during the transit of electricity represent the major operational fields of this organisation, the existence of which is based on the necessity to provide the most favorable environment for electricity market evolvement.

As a full member of ENTSO, the Bulgarian Electricity System Operator signed an Inter- TSO Compensation Agreement (ITC), which is a positive step towards favourable conditions and integration.

Media Coverage of ESO's Activities

In 2007, the activities of ESO EAD were broadly covered by both Bulgarian and foreign mass media. Meetings with journalists, interviews and published materials all rendered an important contribution to raising the general public awareness of what the newly established company is responsible for and the tasks it performs.

On 4 July, the management of ESO EAD held a press conference on the fault that occurred in the Bulgarian power system on 27 June, 2007. A multimedia presentation explained what had caused that major disruption. Representatives of more than 30 national and foreign media were briefed in detail on the structure of ESO EAD and the main aspects of its activity.

Since ESO EAD acts as a principal regulator in the process

of registration of trade actors in the balancing market and because it is in charge of tasks that pertain to power system operational planning, co-ordination and operation, the transmission capacity allocation tenders that the company ran among the national market actors were followed with great media interest and covered in a number of reports and publications in both specialised and daily editions.

By the end of the year, on 21 December, the managements of NEK and ESO held a joint press conference at which they summed up the work done by that point and outlined the overall priorities of the two energy companies for the following year.

However, media were not the only ones to follow the activities of ESO EAD. The company's active work was also highly appreciated by the Bulgarian Branch Chamber of Power Engineers. In June, 2008, Mr. Ivan Ayolov was awarded the prize "Power Engineer of the Year" for his proven professional contribution in various fields of the electric power industry.

The official website of ESO EAD (www.tso.bg) features daily updates on its corporate activity.

Acronym Key

ESO EAD	–	Electricity System Operator EAD
EU	–	European Union
EPS	–	Electric Power System
ETSO	–	European Transmission System Operators
UCTE	–	Union for Co-ordination of Transmission of Electricity
TPP	–	Thermal Power Plant
NEK EAD	–	National Electricity Company
HPP	–	Hydro Power Plant
NPP	–	Nuclear Power Plant
IOC	–	Internal Audit and Control
NDC	–	National Dispatching Center
NOA	–	Network Operation Area
TDC	–	Territorial Dispatching Center
TNOM	–	Transmission Network Operation and Maintenance
ADS	–	Automated Dispatch Systems
ETO	–	Electricity Trade Operator
IT	–	Information Technology
IMFA	–	Investment & Maintenance Forecast and Analysis
IST	–	Information Systems and Technology
EAC	–	External Affairs and Cooperation
OCOH	–	Operation Control and Occupational Health
CLTO	–	Central Laboratory for Transformer Oils
NCPP	–	National Classification of Professions and Positions
NEK PS	–	National Electricity Company – Public Supplier
SCEWR	–	State Commission for Energy and Water Regulation
HV	–	High Voltage
MV	–	Medium Voltage
LR	–	Lightning Rope
WSS	–	Water Supply & Sewage

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