Towards an EU Electricity Market – Highlights of the Western and Southeast European Electricity Markets

THE BULGARIAN ELECTRICITY MARKET ON THE THRESHOLD OF FULL LIBERALIZATION

Executive Peer Exchange
Leipzig
28 May 2007

Victoria Popovska – Head of Electricity Market Operator Division
Electricity System Operator EAD
Bulgaria
HIGHLIGHTS

- REGULATORY AND LEGAL FRAMEWORK
- CURRENT POWER MARKET MODEL
- COMMERCIAL RELATIONS
- UNBUNDLING OF NEK
- THE BULGARIAN ELECTRICITY SYSTEM OPERATOR
- ANALYSIS OF THE MARKET OPERATION
- NEW POWER MARKET AND BALANCING MODEL
- FUTURE DEVELOPMENT
NORMATIVE FRAMEWORK -1

Energy Law approved in December 2003
Amendments and Supplements to the Energy Law
(State Gazette, issue 74/08.09.2006)

Market Rules (State Gazette, issue 67/August 2004)
Amendments and Supplements to the Market Rules
(State Gazette, issue 9/09.02.2007)

Metering Rules (State Gazette, issue 67/August 2004)
Amendments and Supplements to the Metering Rules
(approved by SEWRC)

Transmission Grid Code (State Gazette, issue 67/August 2004)
Amendments and Supplements to the Grid Code
(approved by SEWRC)

Rules for Access to the Transmission and Distribution Networks (State Gazette, issue 67/August 2004)
Amendments and Supplements to the Rules for Third Party Access to the Grid (approved by SEWRC)
Energy Law approved in December 2003

The Energy Law is developed in compliance with the Electricity Directive 2003/54/EC

The Law introduces:

- New market design replacing the “single buyer” model by a model of “bilateral contracts and balancing market”
- Requirements for separate accounting of the activities, that require different licenses
- Further restructuring of NEK and legal unbundling of the transmission and system operation activities from the trading and generation business
- New functions of SEWRC and NEK in its capacity of Transmission company related to the market
ELECTRICITY SECTOR RESTRUCTURING AND MARKET DEVELOPMENT
HISTORY (1999-2007)

**June 2000** Restructuring of NEK from 1 Vertically intergraded company to:
- 1 Transmission Company + Main HPP’s and PSHP
- 7 Distribution Companies
- 1 Independent Nuclear Generator
- 6 Independent Thermal Power Generators

**April 2002** – First Regulated Third Party Access Ordinance
- Eligible Customers >100 GWh/year

**December 2003** – New Energy Law in compliance with Directive 2003/54/EC

**March-August 2004** – Adoption of the secondary legislation

**18.09.2004** - Open market becomes operative
CURRENT BULGARIAN MARKET MODEL -1

Regulated market

G1 TPP, NPP
G2 - RES
G3 - CHP

Export
NEK-Public Supplier
Customers HV

Regulated prices
Freely negotiated prices
PPA

Generators
Public Providers
Customers MV + LV

Transmission Grid
Distribution Grid

JULY 2007

SEPTEMBER 2004

MAY 2007

Open market

G1 TPP, NPP (within Quotas)
Eligible Customers
Traders

Eligible customers

100% Liberalized market

Regulated transactions
Market based transactions

6
REGULATED MARKET

1. The parties are preliminary defined in the Energy law

2. The contracts specify monthly volumes and are not notified to the ESO

3. The relations are settled on the basis of measured quantities

4. The prices are regulated by SEWRC

5. The participants are not subject to balancing
## OPEN MARKET

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The participants have to pass procedure for access to the Grid and Registration on the market</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>All participants are allowed to choose its contracting party from the Register of MP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>The contracts specify hourly quantities of power at freely negotiated prices</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>The contracts are notified to ESO and the Participants are subject to balancing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>ESO calculates two prices of the balancing energy for each settlement period</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
COMMERCIAL RELATIONS – Regulated market

- Contracts for selling electricity to customers
- Contracts for purchasing of availability and power from generators

Customers:
- Full requirement contract with the Public Supplier and/or Public provider
- The price for access and transmission is included in the regulated energy price

Generators:
- Central dispatching
- No separation between electricity needed for the market – regulated and open – and electricity provided as ancillary services
- Generators sells the capacity and energy to NEK - Public Supplier
COMMERCIAL RELATIONS – Open market

- Bilateral contracts between generator/supplier and customer
- Contracts for access to the Grid with BSO
- Contracts for transmission with NEK – TransCo
- Contract for access and transmission with DisCo
- Contracts for covering losses
- Contracts for ancillary services between BSO and Generators
- Contract for balancing with BSO
- Contract for exchange of data between BSO and DisCo
- Conditional contract with SoLR
Independent Producers
Condense type TPP and NPP

Independent Producers – HPP, Industrial Plants, CHP

Traders of energy

Eligible Customers

Power transactions in the transitional stage of market liberalization
When a Participant is deemed “Long”, it sells its surplus energy \((purchased/sold\ under\ bilateral\ contracts,\ but\ not\ consumed/overproduced)\) to the BSO.

When a Participant is deemed “Short”, it is in deficit and buys energy from the BSO.
Current balancing model

<table>
<thead>
<tr>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
</table>

- Every participant in the open market is obliged to sign a Contract for balancing with the Bulgarian System Operator.
- The participants are responsible for their own imbalances and are not allowed to transfer the responsibility for imbalances to Balance Responsible Party.
- This model of balancing is applicable only in the transitional stage of market liberalization.
- Every participant (HV) is obliged to sign a Contract for Access to the Grid with BSO and a Contract for Transmission with NEK.
CONTRACTUAL RELATIONS – OPEN MARKET

- 5 Generators
  - АЕЦ
  - МИ2
  - ТЕЦ В
  - ТЕЦ МЗ
  - ТЕЦ БД

- 10 Traders

- 38 customers

BSO
DIFFERENT MARKETS

Contracting before the delivery day D:
1. Bilateral contracts - only

The participants are allowed to conclude several contracts. The contracts/schedules are notified to ESO

Current Rules:
The schedules cover 168 consecutive hours. The participants are not allowed to modify these schedules

New Rules
The schedules will be notified on a day-ahead basis for all regulated and market-based transactions, including transaction for covering losses

On a later stage – power exchange

Balancing market

BE Sources:
- Generators that are participating in the primary and secondary regulation
- Generators (mainly Hydro) that are participating in the tertiary regulation
- Generators in cold reserve
- Balancing energy from the regional balancing market
Offers and Bids

**Offers**

Offers by participants used in the event of energy shortfall (top up) in the EPS. (Generators increase their output, Consumers reduce their demand);

**Bids**

Offers by participants used in the event of energy surplus (spill) in the EPS. (Generators reduce their output, Consumers increase their demand);
## BALANCING MARKET PARTICULARITIES-2

**Common MERIT ORDER of two main sources of Balancing Energy:**

1) **Tertiary reserve** (Spinning and Cold, but 15-minutes for activation). *Provided by NEK - Public Supplier,* based on the availability purchased from the condense-type plants, own HPP and pumped storage (PSHPP);

2) **Bids and Offers** (Incs and Decs of the Generation and the Demand, but 15-minutes for activation). *Provided by the Market Participants.*

   *Paid-as-Bid;*

### TWO PRICE SYSTEM (Different TOP-UP and SPILL Prices)

1) **Participate in the Imbalance Price by a Marginal Regulated Price**

2) **Participate in the Imbalance Price by an Average Weighted Price**
PRIORITY LIST (MERIT ORDER)

- The Merit order has been prepared on a daily basis by the Electricity Market Operator Division in the Bulgarian System Operator.
- The Merit order contains the registered offers and bids and the available tertiary reserve provided by the generators (condense-type plants), HPP and PSHPP owned by the Public Supplier.
- The offers and the Positive Tertiary Reserve Limit are placed in an ascending order of their prices.
- The Bids and the Negative Tertiary Reserve Limit are placed in a descending order of their prices.
OFFERS
(Merit order)
BALANCING MARKET PARTICULARITIES-5

B I D S
(Merit order)
List of Balancing Energy sources (Priority List)

- B1
- B2
- B3
- PSHPP
- ME2
- Varna
- O1
- Ruse
- B. Dol
- HPP of NEK

Power, MW

Time (h):
00:00 01:00 02:00 03:00

Power (MW):
101-1-20 MW 20 MW 30 MW
101-2-20 MW 20 MW 20 MW
101-30 MW 25 MW 25 MW
301-120 MW 30 MW 20 MW
301-2-40 MW 30 MW 30 MW
301-3-15 MW 20 MW 20 MW
**Structure and principles of the Balancing market**

**Scenarios of balancing OPC= 0**

- Participant are in deficit
- According to the BM Priority List, there are no accepted Offers. The Offers Participation Coefficient (OPC) = 0
- The deficit is compensated by energy supplied only from PS-NEK

**Energy Flows**

- PS-NEK → BSO

**Cash Flows**

- PS-NEK → BM Participants
- BM Participants → Participants in imbalance
- Participants in imbalance → BM Participants
- BM Participants → PS-NEK
- PS-NEK → BSO
- BSO → Participants in imbalance
Structure and principles of the Balancing market

Scenarios of balancing OPC = 0 - 1

- Participant are in deficit
- According to the BM Priority List there are accepted Offers but their energy volume is lower than the Participants deficit (OPC) = 0 - 1
- The deficit is met by using energy partly from PS-NEK and partly from the activated Offers

Energy Flows

Cash Flows
Structure and principles of the Balancing market

Scenarios of balancing $OPC = 1$

- Market Participants are in deficit
- According to the BM Priority List there are accepted Offers and their energy volume is equal to the Participant deficit $OPC = 1$
- No energy is used from PS-NEK.

Energy Flows

Cash Flows
Structure and principles of the Balancing market
Scenarios of balancing OPC > 1

• Market Participants are in deficit
• According to the BM Priority List there are accepted Offers which energy volume is larger than the Participant deficit OPC > 1
• Part of the energy volume under the accepted Offers meet the imbalance in the regulated part of the market. In this case NEK-PS is subject to balancing

Energy Flows

Cash Flows
Structure and principles of the Balancing market

Scenarios of balancing BPC = 0

- Market Participants are in surplus
- According to the BM Priority List there are no accepted Bids. Bids Participation Coefficient (BPC) = 0
- The spill energy is compensated (purchased) only by PS-NEK.

Energy Flows

Cash Flows
Structure and principles of the Balancing market

Scenarios of balancing BPC = 0 - 1

- Market Participants are in surplus

- Bids are accepted according to the BM Priority List but cannot take the entire surplus energy volume of the Participants BPC = 0 - 1

- The spill energy is compensated (purchased) partly by PS-NEK and partly by activated Bids.

Energy Flows

Cash Flows
Structure and principles of the Balancing market

Scenarios of balancing $BPC = 1$

- Market Participants are in surplus
- The accepted Bids according to the BM Priority List match fully the entire surplus energy of the Participants $BPC = 1$
- PS-NEK does not compensate (purchase) any spill energy.

Energy Flows

Cash Flows
Structure and principles of the Balancing market

Scenarios of balancing $BPC = > 1$

- Market Participants are in surplus
- The volume of the accepted Bids according to the BM Priority List is higher than the surplus energy from the Participants, $BPC > 1$
- The accepted Bids compensate also for part of the surplus in the regulated part of the market. In this case NEK-PS is subject to balancing

Energy Flows

Cash Flows
Pricing methodology
Imbalance Price – for Deficit

PED_j = (1-OPC_j)PEM_j + OPC_jPEOwgh_j

Where:

PED_j is a Top up price for period j

PEM_j is a price calculated on the basis of the marginal price of the condense-type thermal units that are in operation during period j, BGL/кWh

PEOwgh_j is a weighted average price calculated from the accepted offers in the Balancing Market for period j;
Pricing methodology

Imbalance Price – for Surplus

\[ \text{PES}_j = (1 - \text{BPC}_j) \text{PEF}_j + \text{BPC}_j \text{PEB}_{wghj} \]

Where:

\( \text{PES}_j \) is a Spill price for period \( j \)

\( \text{PEF}_j \) is a price calculated on the basis of the lowest energy price (fuel component) of the condense-type thermal units that are in operation in period \( j \), BGL/\( \)kWh

\( \text{PEB}_{wghj} \) is a weighted average price calculated from the accepted bids in the Balancing Market for period \( j \);
BULGARIAN ELECTRICITY SYSTEM OPERATOR

- Transmission System Operator
- Balancing Market Operator
- Operation of the transmission network on the basis of a contract with NEK
HIGHLIGHTS

- REGULATORY AND LEGAL FRAMEWORK
- CURRENT POWER MARKET MODEL
- COMMERCIAL RELATIONS
- UNBUNDLING OF NEK. BULGARIAN ELECTRICITY SYSTEM OPERATOR
- ANALYSIS OF THE MARKET OPERATION
- NEW POWER MARKET AND BALANCING MODEL
- FUTURE DEVELOPMENT
<table>
<thead>
<tr>
<th><strong>NORMATIVE FRAMEWORK -1</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy Law</strong> approved in December 2003</td>
</tr>
<tr>
<td>Amendments and Supplements to the Energy Law</td>
</tr>
<tr>
<td>(State Gazette, issue 74/08.09.2006)</td>
</tr>
<tr>
<td><strong>Market Rules</strong> (State Gazette, issue 67/August 2004)</td>
</tr>
<tr>
<td>Amendments and Supplements to the Market Rules</td>
</tr>
<tr>
<td>(State Gazette, issue 9/09.02.2007)</td>
</tr>
<tr>
<td><strong>Metering Rules</strong> (State Gazette, issue 67/August 2004)</td>
</tr>
<tr>
<td>Amendments and Supplements to the Metering Rules</td>
</tr>
<tr>
<td>(approved by SEWRC)</td>
</tr>
<tr>
<td><strong>Transmission Grid Code</strong> (State Gazette, issue 67/August 2004)</td>
</tr>
<tr>
<td>Amendments and Supplements to the Grid Code</td>
</tr>
<tr>
<td>(approved by SEWRC)</td>
</tr>
<tr>
<td><strong>Rules for Access to the Transmission and Distribution Networks</strong> (State Gazette, issue 67/August 2004)</td>
</tr>
<tr>
<td>Amendments and Supplements to the Rules for Third Party Access to the Grid</td>
</tr>
<tr>
<td>(approved by SEWRC)</td>
</tr>
</tbody>
</table>
Public Supplier and Public Providers are obliged to purchase electricity from RES and CHP at preferential prices.

All residual customers and small industrial (up to 50 people personnel and up to 10 million EUR turnover) will form the group of “protected customers”, that shall have the right to continue to be supplied at regulated prices.

SEWRC shall determine Quotas as from July 2007 for TPP and NPP (net availability) that have to be released at regulated prices for covering the demand of “protected customers”.

Price for transmission service is divided into two components: price for “access to the grid” that has to be paid to the Electricity System Operator and price for “transmission of electricity”, that has to be paid to the NEK in its capacity of Transmission Company.
NORMATIVE FRAMEWORK -3

Amendments and Supplements to the Market Rules
(State Gazette, issue 9/09.02.2007)

- The Registration of hourly schedules for supply of electricity is organized on weekly basis
- All Market Participants changing the Supplier of electricity are subject to balancing
- The Rules regulate the procedure for registration of Traders and Generators for Cross Border Transactions
- The Rules specify the basis for concluding contracts for access and transmission – who is paying, how much is paying
- Market Participants are not allowed to transfer the responsibility of their imbalances to other party and are responsible for their own imbalances
- Currently the only provider of balancing energy is NEK in its capacity of Public Supplier
LIBERALIZATION OF CROSS-BORDER TRADE

RULES FOR ALLOCATION OF CROSS BORDER CAPACITIES

- Under final coordination with HTSO
- Yearly, monthly and weekly explicit auctions
- Yearly auction for the period from July until December 2007
- Weekly auctions for capacities returned to ESO
- Daily auction on a later stage that will replace the weekly auctions
- Transfers of capacities on a later stage
## MARKET OPERATION

### 2005

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of market participants</td>
<td>23</td>
</tr>
<tr>
<td>Total number of registered schedules</td>
<td>591</td>
</tr>
<tr>
<td>Total traded quantity to end customer</td>
<td>2,607,023 MWh</td>
</tr>
<tr>
<td>Transactions via traders</td>
<td>104,449 MWh (3.85%)</td>
</tr>
</tbody>
</table>

### 2006

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of market participants</td>
<td>51</td>
</tr>
<tr>
<td>Total number of registered schedules</td>
<td>1,320</td>
</tr>
<tr>
<td>Total traded quantity to end customer</td>
<td>3,214,552 MWh</td>
</tr>
<tr>
<td>Transactions via traders</td>
<td>925,479 MWh (28%)</td>
</tr>
<tr>
<td>Year</td>
<td>Total Deficit</td>
</tr>
<tr>
<td>------</td>
<td>------------------------</td>
</tr>
<tr>
<td>2005</td>
<td>43,214 MWh (1.65%)</td>
</tr>
<tr>
<td>2006</td>
<td>69,358 MWh (2.15%)</td>
</tr>
</tbody>
</table>
## PARTICIPATION OF THE GENERATORS IN THE OPEN MARKET

<table>
<thead>
<tr>
<th>Year</th>
<th>TPPV</th>
<th>M3</th>
<th>ME2</th>
<th>NPP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1'06</td>
<td>0.0638</td>
<td>0.0182</td>
<td>0.3864</td>
<td>0.5316</td>
</tr>
<tr>
<td>2'06</td>
<td>0.0655</td>
<td>0.0170</td>
<td>0.3321</td>
<td>0.5854</td>
</tr>
<tr>
<td>3'06</td>
<td>0.0791</td>
<td>0.0100</td>
<td>0.2816</td>
<td>0.6293</td>
</tr>
<tr>
<td>4'06</td>
<td>0.0850</td>
<td>0.0185</td>
<td>0.2863</td>
<td>0.6102</td>
</tr>
<tr>
<td>5'06</td>
<td>0.0869</td>
<td>0.0035</td>
<td>0.2853</td>
<td>0.6242</td>
</tr>
<tr>
<td>6'06</td>
<td>0.0850</td>
<td>0.0016</td>
<td>0.2604</td>
<td>0.6530</td>
</tr>
<tr>
<td>7'06</td>
<td>0.0788</td>
<td>0.0062</td>
<td>0.1014</td>
<td>0.8136</td>
</tr>
<tr>
<td>8'06</td>
<td>0.0622</td>
<td>0.0021</td>
<td>0.0146</td>
<td>0.9211</td>
</tr>
<tr>
<td>9'06</td>
<td>0.0560</td>
<td>0.0013</td>
<td>0.0083</td>
<td>0.9344</td>
</tr>
<tr>
<td>10'06</td>
<td>0.0128</td>
<td>0.0011</td>
<td>0.0000</td>
<td>0.9862</td>
</tr>
<tr>
<td>11'06</td>
<td>0.0004</td>
<td>0.0019</td>
<td>0.0000</td>
<td>0.9977</td>
</tr>
<tr>
<td>12'06</td>
<td>0.0002</td>
<td>0.0020</td>
<td>0.0002</td>
<td>0.9976</td>
</tr>
<tr>
<td>01'07</td>
<td>0.0003</td>
<td>0.0022</td>
<td>0.0067</td>
<td>0.9977</td>
</tr>
<tr>
<td>02'07</td>
<td>0.0003</td>
<td>0.0021</td>
<td>0.0000</td>
<td>0.9976</td>
</tr>
<tr>
<td>03'07</td>
<td>0.0003</td>
<td>0.0023</td>
<td>0.0000</td>
<td>0.9974</td>
</tr>
</tbody>
</table>

The chart above shows the participation of different generators in the open market from 2006 to 2017. The bars indicate the percentage participation over time.
PARTICIPATION OF THE GENERATORS IN THE OPEN MARKET

- TPPV
- TPPM3
- TPPME2
- NPP

MWh

0 50000 100000 150000 200000 250000 300000 350000

Time Period:
1'06 2'06 3'06 4'06 5'06 6'06 7'06 8'06 9'06 10'06 11'06 12'06 01'07 02'07 03'07 04'07
REGISTER OF MARKET PARTICIPANTS

September 2004 - December 2005

[Bar chart showing the number of market participants by month from September 2004 to December 2005, categorized as Producers, Consumers, NEK-PS, and Traders.]
REGISTER OF MARKET PARTICIPANTS

December 2005 – April 2007

[Bar chart showing participation trends from December 2005 to April 2007]
BILATERAL CONTRACT MARKET

Monthly Quantities traded at freely negotiated prices

Monthly contracted quantities of electricity, MWh

<table>
<thead>
<tr>
<th>Year</th>
<th>Q -ties traded via traders</th>
<th>Q -ties traded to end customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>9'04</td>
<td>0</td>
<td>11472</td>
</tr>
<tr>
<td>10'04</td>
<td>2500</td>
<td>38410</td>
</tr>
<tr>
<td>11'04</td>
<td>5000</td>
<td>50747</td>
</tr>
<tr>
<td>12'04</td>
<td>131754</td>
<td>131754</td>
</tr>
<tr>
<td>1'05</td>
<td>167901</td>
<td>167901</td>
</tr>
<tr>
<td>2'05</td>
<td>140873</td>
<td>140873</td>
</tr>
<tr>
<td>3'05</td>
<td>195459</td>
<td>195459</td>
</tr>
<tr>
<td>4'05</td>
<td>215407</td>
<td>215407</td>
</tr>
<tr>
<td>5'05</td>
<td>222106</td>
<td>222106</td>
</tr>
<tr>
<td>6'05</td>
<td>220302</td>
<td>220302</td>
</tr>
<tr>
<td>7'05</td>
<td>228853</td>
<td>228853</td>
</tr>
<tr>
<td>8'05</td>
<td>231564</td>
<td>231564</td>
</tr>
<tr>
<td>9'05</td>
<td>214998</td>
<td>214998</td>
</tr>
<tr>
<td>10'05</td>
<td>249262</td>
<td>249262</td>
</tr>
<tr>
<td>11'05</td>
<td>250687</td>
<td>250687</td>
</tr>
<tr>
<td>12'05</td>
<td>269611</td>
<td>269611</td>
</tr>
</tbody>
</table>
BILATERAL CONTRACT MARKET

Monthly Quantities traded at freely negotiated prices

- Q-ty traded via traders
- Q-ty traded to end users
BILATERAL CONTRACT MARKET

05 - 11 May 2007

Weekly delivery schedules - 50
Total quantity of power - 62255.4 MWh
Regulated Prices

Generators

Lev MWH

NPP TPPV TPPME2 TPPR TPPBD TPPM3 TPPME3 HPP1 HPP2 WindG1 WindG2 WindG3

Availability Energy Access Transmission
PARTICIPATION OF NEK – PUBLIC SUPPLIER IN THE BALANCING MARKET

In 2006 NEK in its capacity of Public Supplier was the only provider of the balancing energy.
BALANCING MARKET

TOTAL HOURLY IMBALANCES

Week 6
10.02.2007 - 16.02.07

MWh
Credits of the TSO:
- Sold Energy from Activated bids (paid as bid)
- Sold Energy for covering deficits of participants
- Sold Energy to the Public Supplier from surpluses
- Sold Energy for deficit of the Public Supplier

Debts of the TSO:
- Purchased Energy from Accepted offers (paid as bid)
- Purchased Energy from surpluses of participants
- Purchased Energy from the Public Supplier for covering the deficits of the participants
- Purchased Energy for surpluses of the Public Supplier

Credits of the TSO = Debits of the TSO (in every period)
BALANCING MARKET

APRIL 2007

Imbalances

- Energy Surplus
- Energy Deficit
Balancing Energy

Average monthly prices, lev/MWh

1 lev (BGN) = 1.95 EUR

- Top Up Price
- Spill Price

Data from 2001 to 2007.
## BALANCING ENERGY PRICES -2

### 28 April - 04 May 2007

<table>
<thead>
<tr>
<th>Date</th>
<th>Top-up Price</th>
<th>Spill Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAT 28.04.07</td>
<td>90.00</td>
<td>30.00</td>
</tr>
<tr>
<td>SUN 29.04.07</td>
<td>90.00</td>
<td>30.00</td>
</tr>
<tr>
<td>MON 30.04.07</td>
<td>90.00</td>
<td>30.00</td>
</tr>
<tr>
<td>TUE 01.05.07</td>
<td>90.00</td>
<td>30.00</td>
</tr>
<tr>
<td>WED 02.05.07</td>
<td>90.00</td>
<td>30.00</td>
</tr>
<tr>
<td>TUE 03.05.07</td>
<td>90.00</td>
<td>30.00</td>
</tr>
<tr>
<td>FRI 04.05.07</td>
<td>90.00</td>
<td>30.00</td>
</tr>
</tbody>
</table>

### Graphical Representation

![Graph showing the energy prices from 28 April to 04 May 2007](image_url)
STRUCTURE OF THE PURCHASED AND SOLD ELECTRICITY BY NEK IN 2006

Electricity purchased by the Public Supplier

- 79.00%
- 7.85%
- 8.68%
- 1.22%
- 0.45%
- 2.80%

Electricity sold by the Public Supplier

- 60.61%
- 15.75%
- 22.63%
- 0.18%
- 0.83%
MARKET OPERATION
Proportion of regulated market demand to non-regulated market demand for HV customers

![Bar chart showing industry HV demand from 2006 to 2006 with percentage values.

2006
Industry HV - Regulated/Open Market, MWh/month

- Industry HV, Regulated market, MWh
- Total consumption - Open Market, MWh

Percentage values for each month:
- January 2006: 50.7%
- February 2006: 45.0%
- March 2006: 43.1%
- April 2006: 44.0%
- May 2006: 44.0%
- June 2006: 41.9%
- July 2006: 44.5%
- August 2006: 53.4%
- September 2006: 55.2%
- October 2006: 53.3%
- November 2006: 55.5%
- December 2006: 52.4%
MARKET OPERATION

Proportion of total regulated market demand to non-regulated market

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Consumption - Regulated Market, MWh</th>
<th>Total Consumption - Open Market, MWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>1'06</td>
<td>2,000,000</td>
<td>1,000,000</td>
</tr>
<tr>
<td>2'06</td>
<td>2,500,000</td>
<td>1,500,000</td>
</tr>
<tr>
<td>3'06</td>
<td>3,000,000</td>
<td>2,000,000</td>
</tr>
<tr>
<td>4'06</td>
<td>3,500,000</td>
<td>2,500,000</td>
</tr>
<tr>
<td>5'06</td>
<td>4,000,000</td>
<td>3,000,000</td>
</tr>
<tr>
<td>6'06</td>
<td>4,500,000</td>
<td>3,500,000</td>
</tr>
<tr>
<td>7'06</td>
<td>5,000,000</td>
<td>4,000,000</td>
</tr>
<tr>
<td>8'06</td>
<td>5,500,000</td>
<td>4,500,000</td>
</tr>
<tr>
<td>9'06</td>
<td>6,000,000</td>
<td>5,000,000</td>
</tr>
<tr>
<td>10'06</td>
<td>6,500,000</td>
<td>5,500,000</td>
</tr>
<tr>
<td>11'06</td>
<td>7,000,000</td>
<td>6,000,000</td>
</tr>
<tr>
<td>12'06</td>
<td>7,500,000</td>
<td>6,500,000</td>
</tr>
</tbody>
</table>

2006
Final Consumption - Regulated/Open Market, MWh/month

- Total consumption - Regulated Market, MWh
- Total consumption - Open Market, MWh

9.9%
HIGHLIGHTS

- REGULATORY AND LEGAL FRAMEWORK
- CURRENT POWER MARKET MODEL
- COMMERCIAL RELATIONS
- UNBUNDLING OF NEK. BULGARIAN ELECTRICITY SYSTEM OPERATOR
- ANALYSIS OF THE MARKET OPERATION
- NEW POWER MARKET AND BALANCING MODEL
- FUTURE DEVELOPMENT
New Market Rules from 01.01.2008
(in a process of development)

- The Registration of Hourly Schedules for Supply of Electricity will be organized on a Daily Basis for all Transactions – Regulated and Market based
- Introduction of Balance Group Arrangements
- Development of Rules for Calculation of Imbalances of Standard and Special Balance Groups
- Introduction of Market Based Mechanism for Selection of Balancing Energy Sources and Operation of the Balancing market
- Introduction of Methodology for Standard Load Profiles
FUTURE DEVELOPMENTS

1. Liberalization of the market for Generators (Hourly commitments within the working capacity range)

2. Introduction of hourly schedules in the regulated and open market

3. Introduction of market based mechanisms for operation of the balancing energy market
Elaboration of transparency mechanism for calculation of the balancing energy prices taking into consideration:

- Expenses of the BSO for payment of the energy provided as result of participation in the primary and secondary regulation
- Expenses of the BSO for payment of the energy provided under activated Offers and Bids
- Expenses of the BSO for payment of capacity and energy from activated units in “could reserve”, including start up and shut down costs
- Expenses of the BSO for balancing energy provided under regional balancing market
Future changes in the power market model

- All Generators have to contract electricity for the market on an hour by hour basis within the working range of the units
- Participation of the Generators in the Primary, Secondary and Tertiary Regulation (ancillary service market) has to be remunerated separately by the BSO
- Expenses of the BSO for balancing the system in real time for each settlement period have to be differentiated as per balancing energy sources and type reserve
- All expenses made by the BSO for each settlement period have to be covered by the BE prices imposed to the participants for the respective imbalance volume for that period

Market based mechanism for calculation of real prices of BE on the basis of real costs of the BSO is possible only after introduction of hourly schedules for all transactions – regulated and market based
NEW BALANCING MODEL

BG №1

G1-BGR

100

65

35

G2

75

15

90

80

№1

75

15

T-BGR

20

BG №2

№2

Т

BGR

20

90

C

C

C

C

Д-1

Д

C

C

C

C

131

ED

20

100

EK

20

90

Deficit (-61)

Prognosis/Schedule

Energy Debit (ED)

Measured Quantity

Energy Credit (EK)
RELATIONS OF ESO ACCORDING TO THE NEW POWER MARKET MODEL

The forecast is for establishment of no more than 15-20 Balancing groups
Each balancing group has its coordinator – licensed party according to art. 39 of the Energy Law

**Standard balancing group**
- Generators
- Electricity Traders

**Special balancing group**
- Public Supplier - NEK
- Public Providers
- Transmission company - NEK
- Distribution company
- Electricity System Operator
Organization and settlement of balancing groups (BG) -1

Each balancing group has an energy account with the ESO

Debit of account

- Consumed energy (measured) of all members and their metering points belonging to the BG
- Energy volumes of all contracts for selling energy to other BG and/or export contracts
- Balancing energy provided as per activated offers, including energy provided as result of primary and secondary regulation - upward regulation
Organization and settlement of balancing groups (BG) -2

Each balancing group has an energy account with the ESO

Credit of account

- Generated energy (measured) of all members and their metering points belonging to the BG
- Energy volumes of all contracts for purchasing energy from other BG and/or import contracts
- Balancing energy from activated bids, including energy provided as result of primary and secondary regulation - downward regulation
Advantages of the new model -1

Market means a lot of information that have to be exchanged between Market Participants and ESO.

System Operator elaborates each day prognosis of the balancing energy needed for balancing the system in real time according to the registered schedules in day D-1.

Market means penalties for some participants and financial incentives for other participants.
Advantages of the new model -2

Market means clear and strong Rules for determination which participants have to be penalized and how much and which participants have to be remunerated and how much

Market means the ESO to maintain contacts not with all market participants, but only with BG Coordinators (BGRP) which relations are much more effective and operational
Advantages of the new model -3

The model of balancing group has as a result decreasing of imbalance volumes and final energy price for customers.

The new balancing model is the only possible model for 100% liberalized market.
FUTURE DEVELOPMENT

- DEVELOPMENT OF NEW MARKET RULES

- FINALIZATION OF THE PROJECT FOR COMMISSIONING AND CONFIGURATION OF IT SYSTEM FOR ADMINISTRATION OF THE COMPETITIVE ELECTRICITY MARKET BY ESO

- SCADA, ENERGY MANAGEMENT SYSTEM, SCHEDULING SYSTEM, BALANCING MARKET AND SETTLEMENT SYSTEM SHALL BE INTEGRATED ALTOGETHER TO ALLOW THE USER TO OPERATE THE MARKET DRIVEN OPERATIONS IN AN EFFECTIVE MANNER
THANK YOU FOR YOUR ATTENTION!

www.tso.bg
vpopovska@nek.bg

phone: +359 2 9263 605