

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

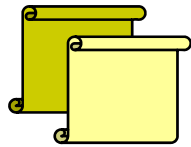
28 May 2007

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

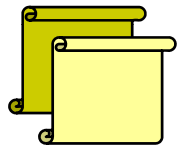
HIGHLIGHTS

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- ❖ **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**

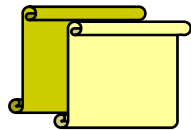
NORMATIVE FRAMEWORK -1



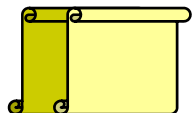
Energy Law approved in December 2003
Amendments and Supplements to the Energy Law
(State Gazette, issue 74/08.09.2006)



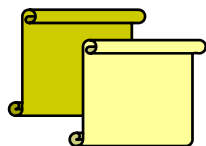
Market Rules (State Gazette, issue 67/August 2004)
Amendments and Supplements to the Market Rules
(State Gazette, issue 9/09.02.2007)



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

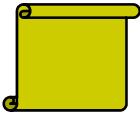


Transmission Grid Code (State Gazette, issue 67/August 2004)
Amendments and Supplements to the Grid Code
(approved by SEWRC)



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)

NORMATIVE FRAMEWORK -2



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 PSHPP
- 7 Distribution Companies
- 1 Independent Nuclear Generator
- 6 Independent Thermal Power Generators

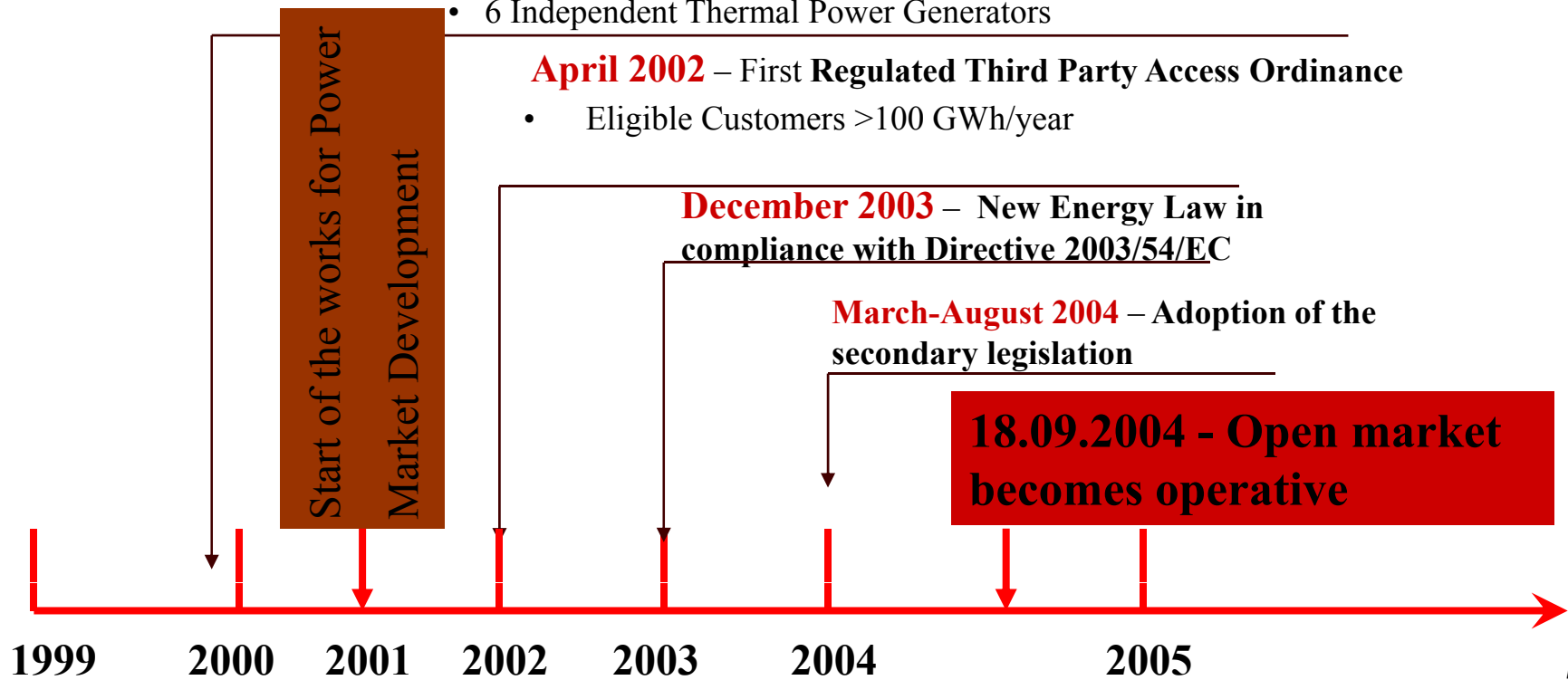
April 2002 – First Regulated Third Party Access Ordinance

- Eligible Customers >100 GWh/year

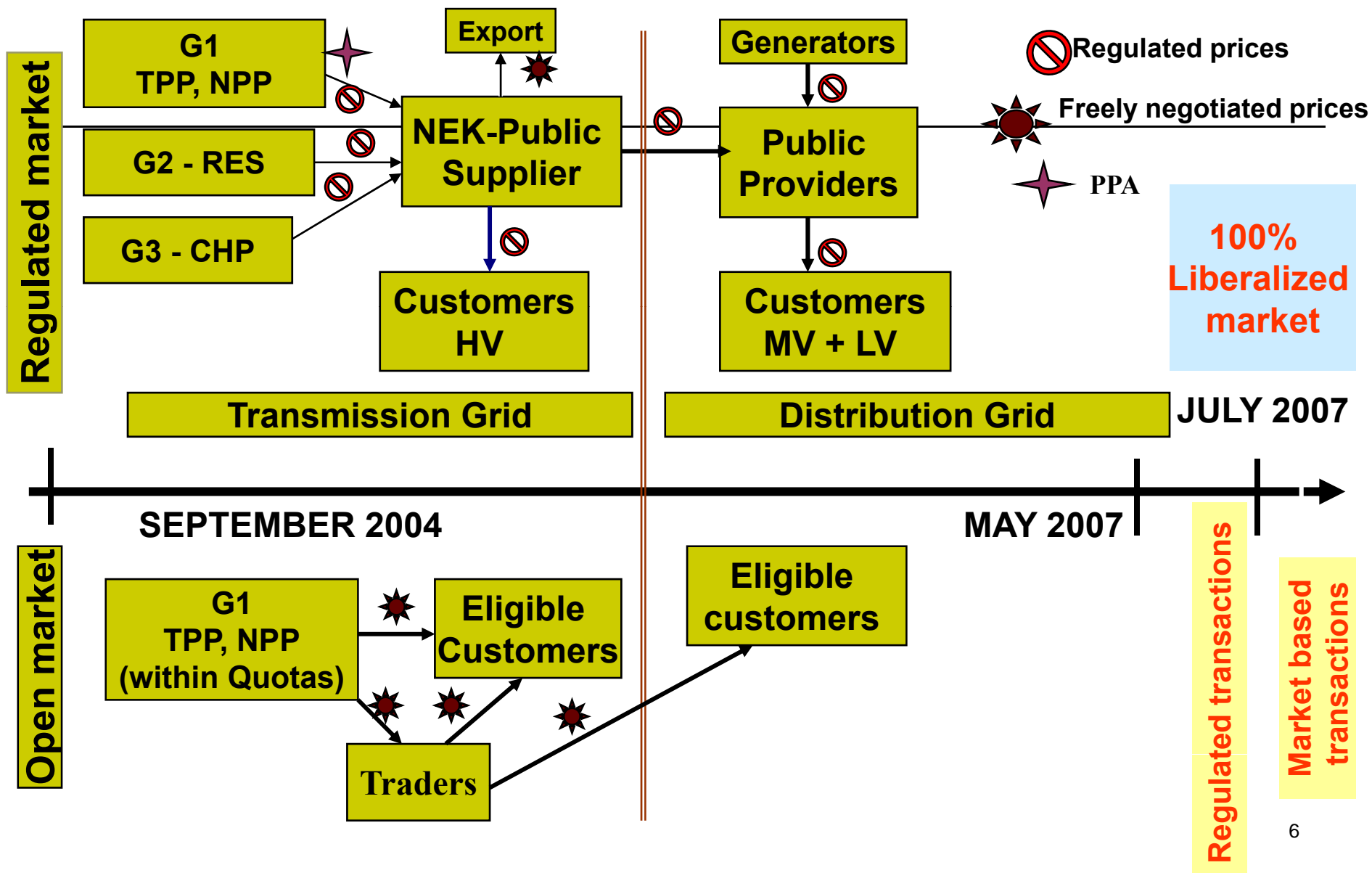
December 2003 – New Energy Law in compliance with Directive 2003/54/EC

March-August 2004 – Adoption of the secondary legislation

18.09.2004 - Open market becomes operative



CURRENT BULGARIAN MARKET MODEL -1



REGULATED MARKET

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

1

The participants have to pass procedure for access to the Grid and Registration on the market

2

All participants are allowed to choose its contracting party from the Register of MP

3

The contracts specify hourly quantities of power at freely negotiated prices

4

The contracts are notified to ESO and the Participants are subject to balancing

5

ESO calculates two prices of the balancing energy for each settlement period



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:

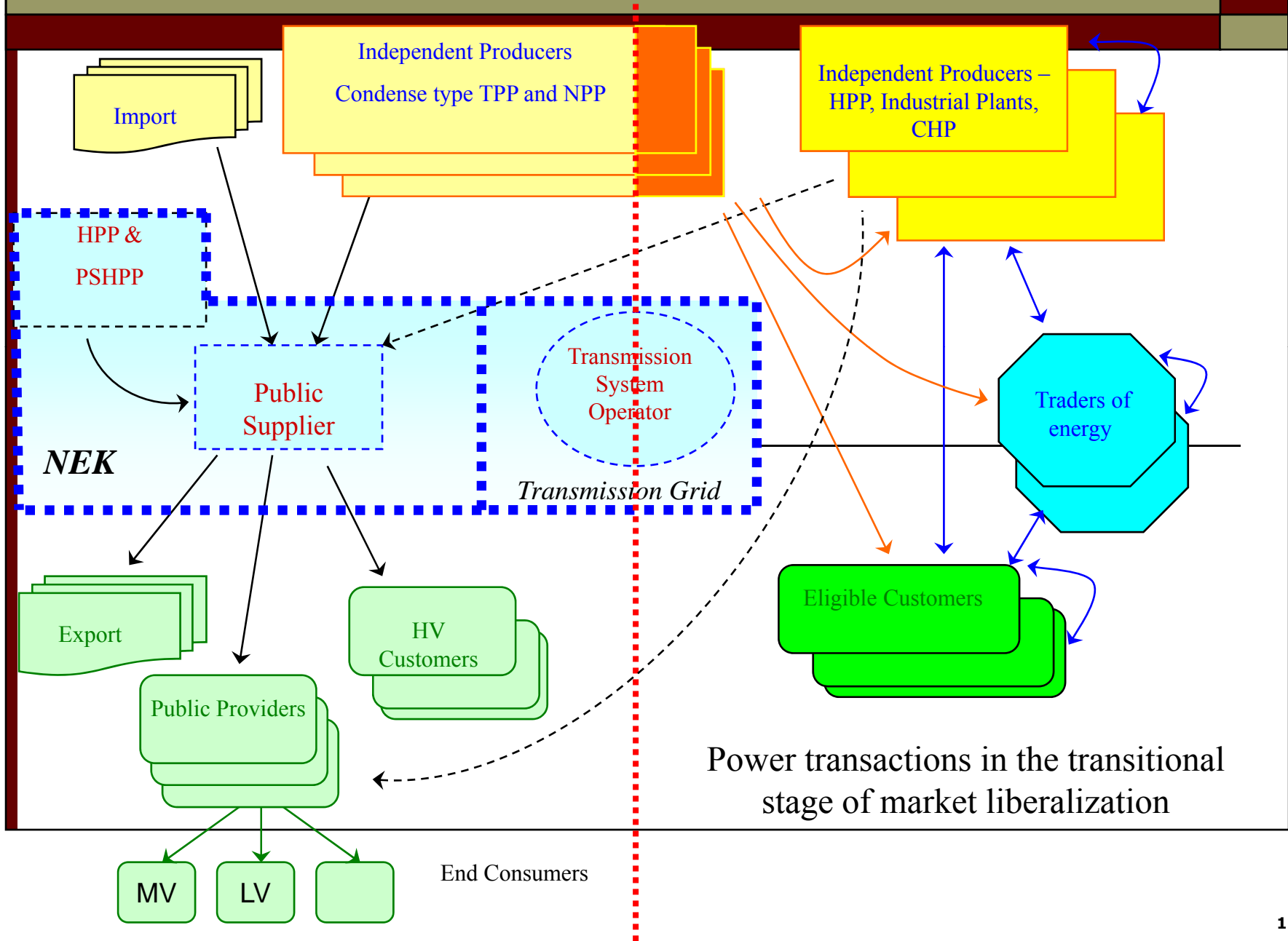
- **Central dispatching**
- **No separation between electricity needed for the market – regulated and open - and electricity provided as ancillary services**
- **Generators sells the capacity and energy to NEK - Public Supplier**



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**

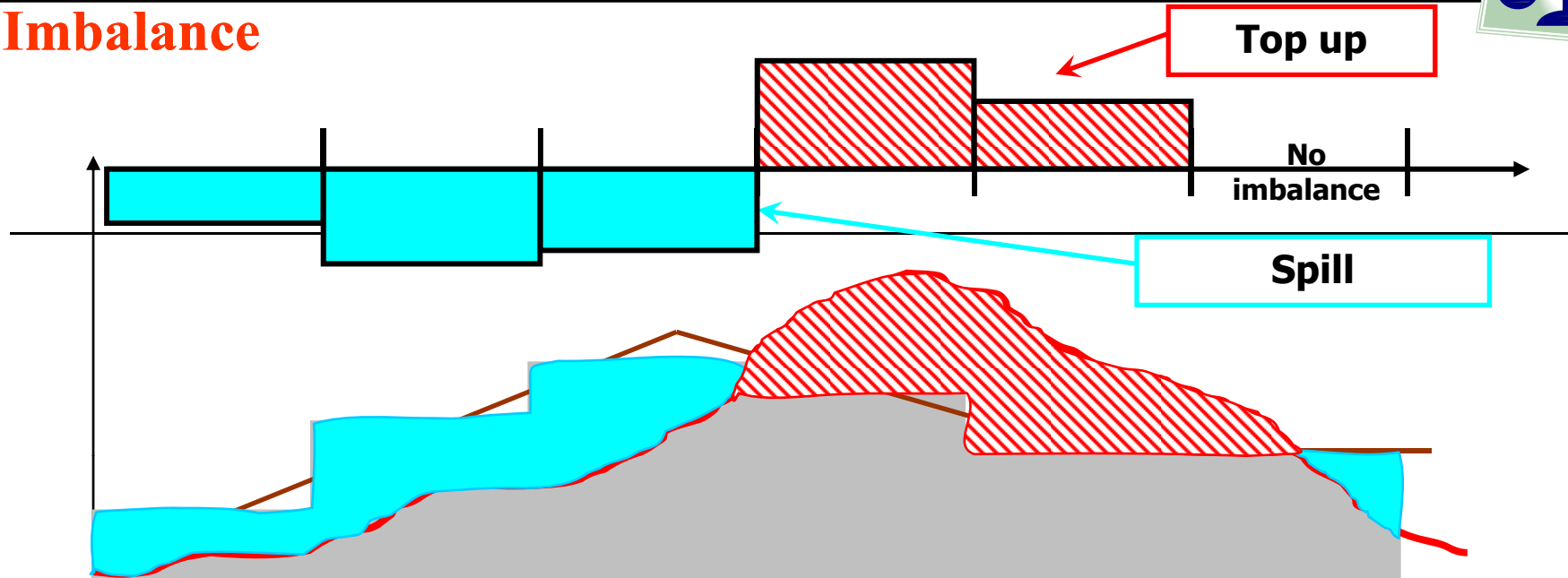
BULGARIAN POWER MARKET MODEL (2)



Main principles of contracting in the open market



Imbalance



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

2004

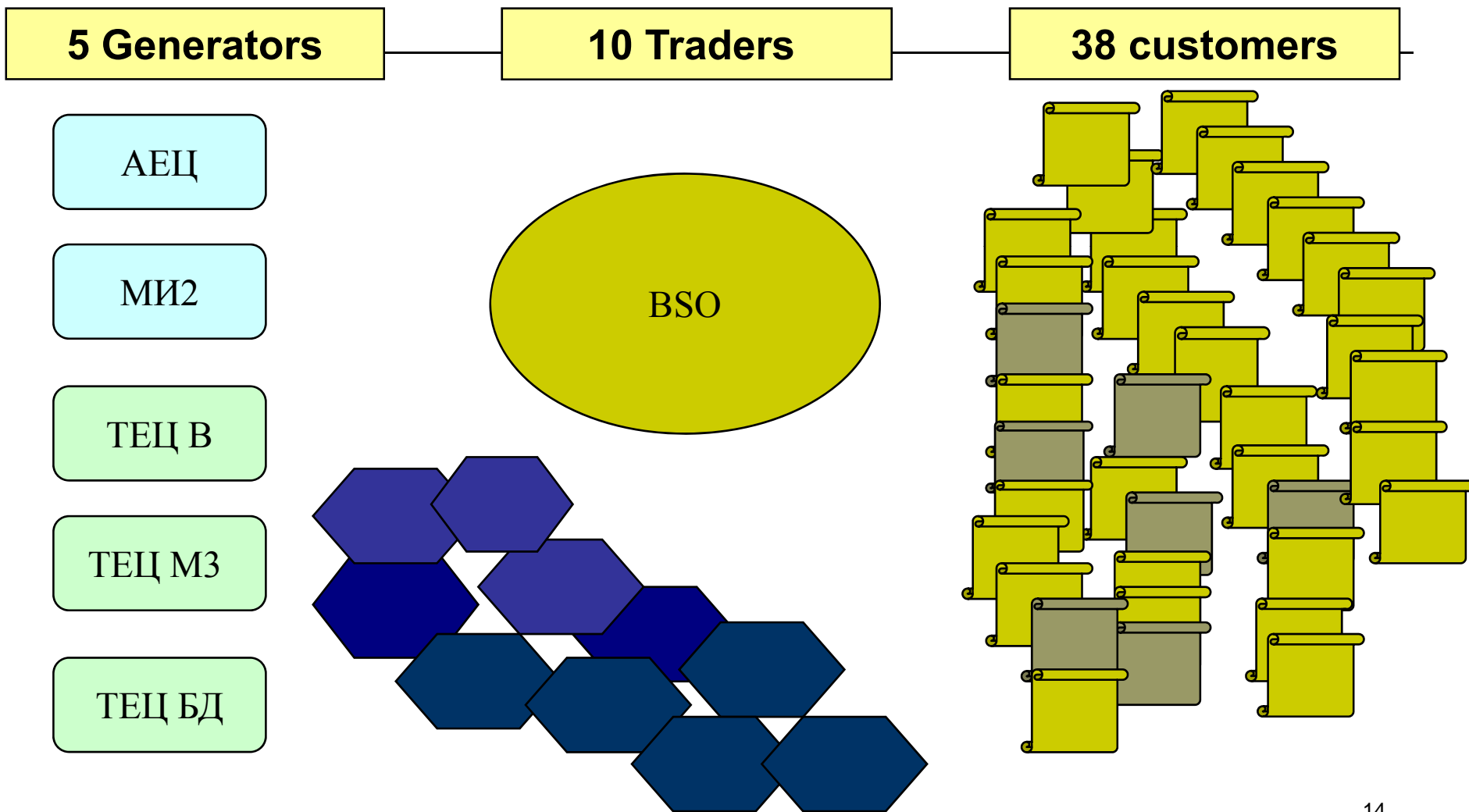
2005

2006

2007

- **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



DIFFERENT MARKETS

Contracting before the delivery day D:

1. Bilateral contracts - only

Only one provider of BE – NEK
on the basis of regulated prices

Settlement and invoicing
after day D

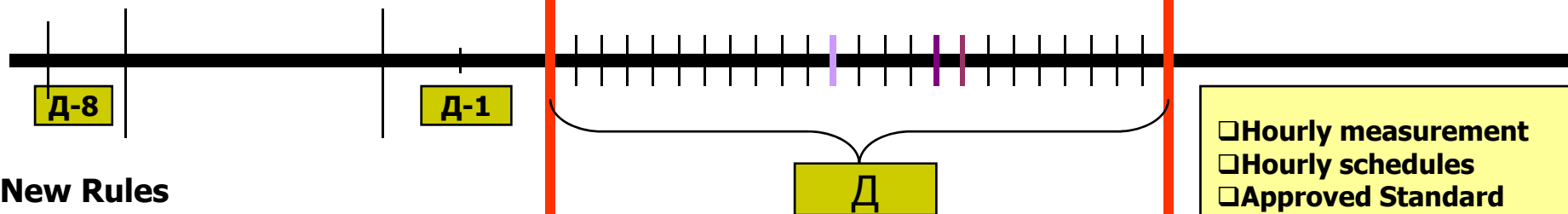
The participants are allowed to conclude several Contracts. The contracts/schedules are notified to ESO

- Hourly schedules
- Hourly measurements

Current Rules:

The schedules cover 168 consecutive Hours. The participants are not allowed to modify these schedules

Balancing market



- Hourly measurement
- Hourly schedules
- Approved Standard Load Profiles
- Activated BE Sources

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

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**

BALANCING MARKET PARTICULARITIES -1

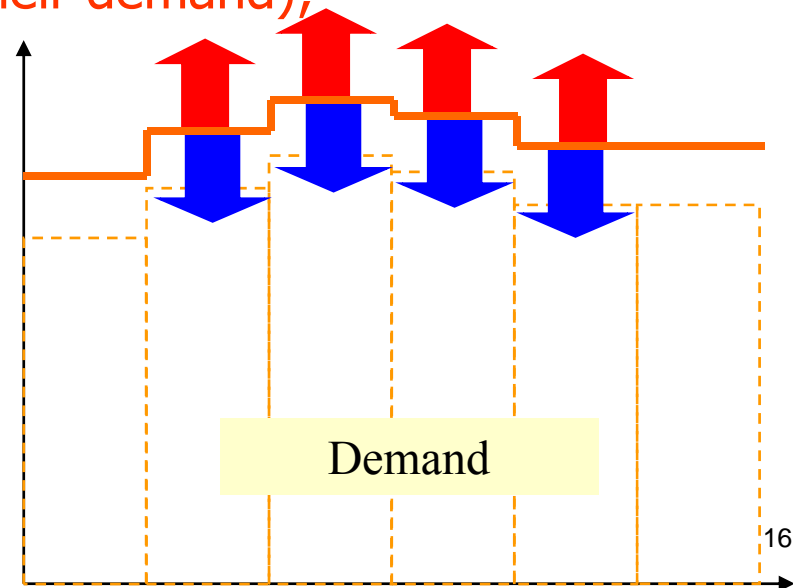
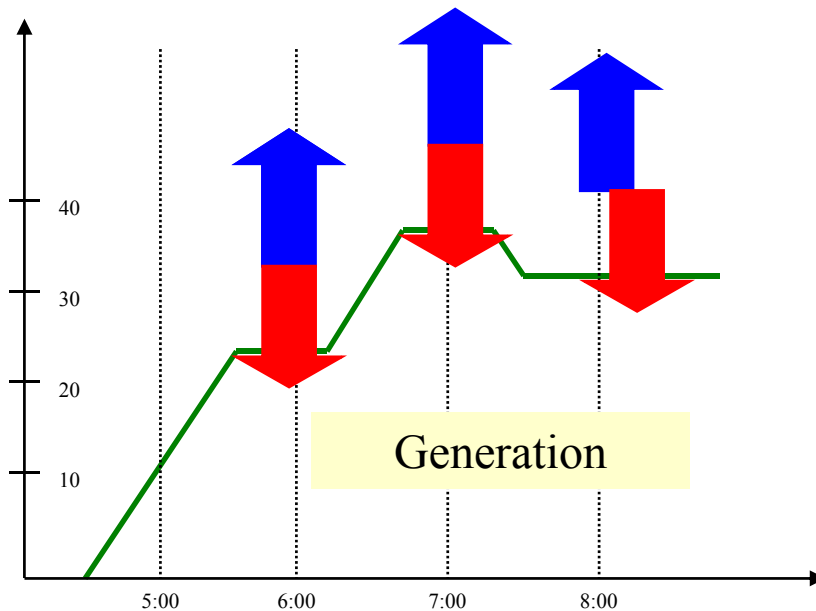
Offers and Bids

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**



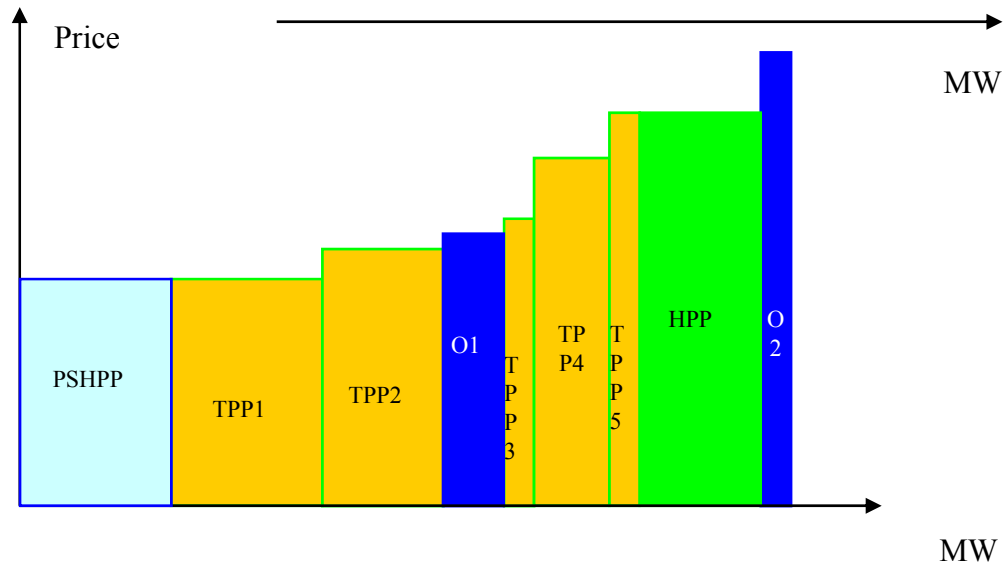
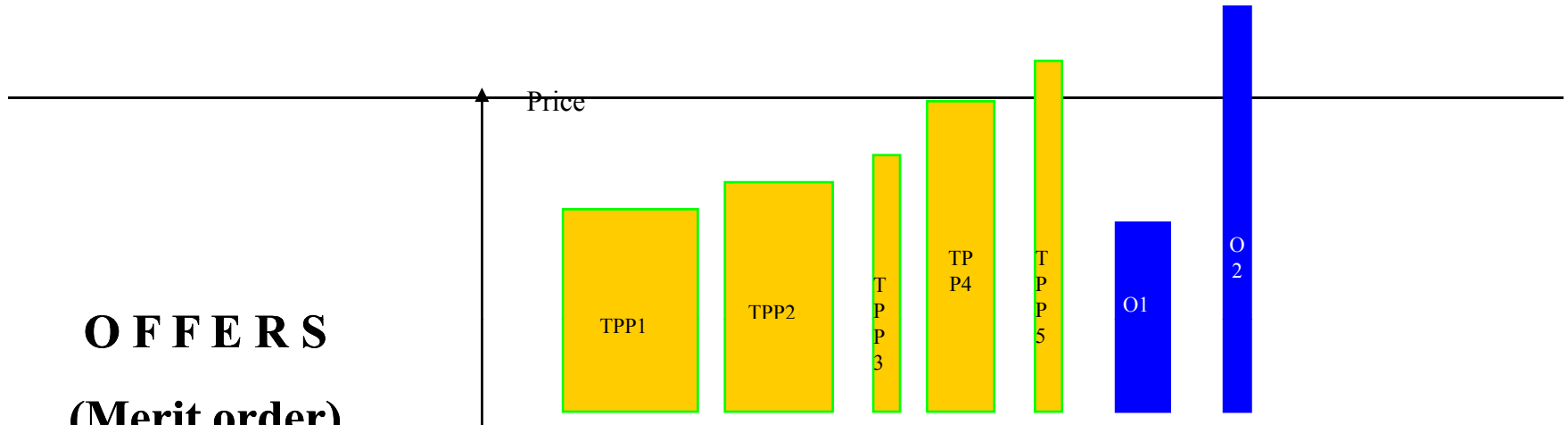
BALANCING MARKET PARTICULARITIES-3

PRIORITY LIST (MERIT RDER)

- ❖ **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**

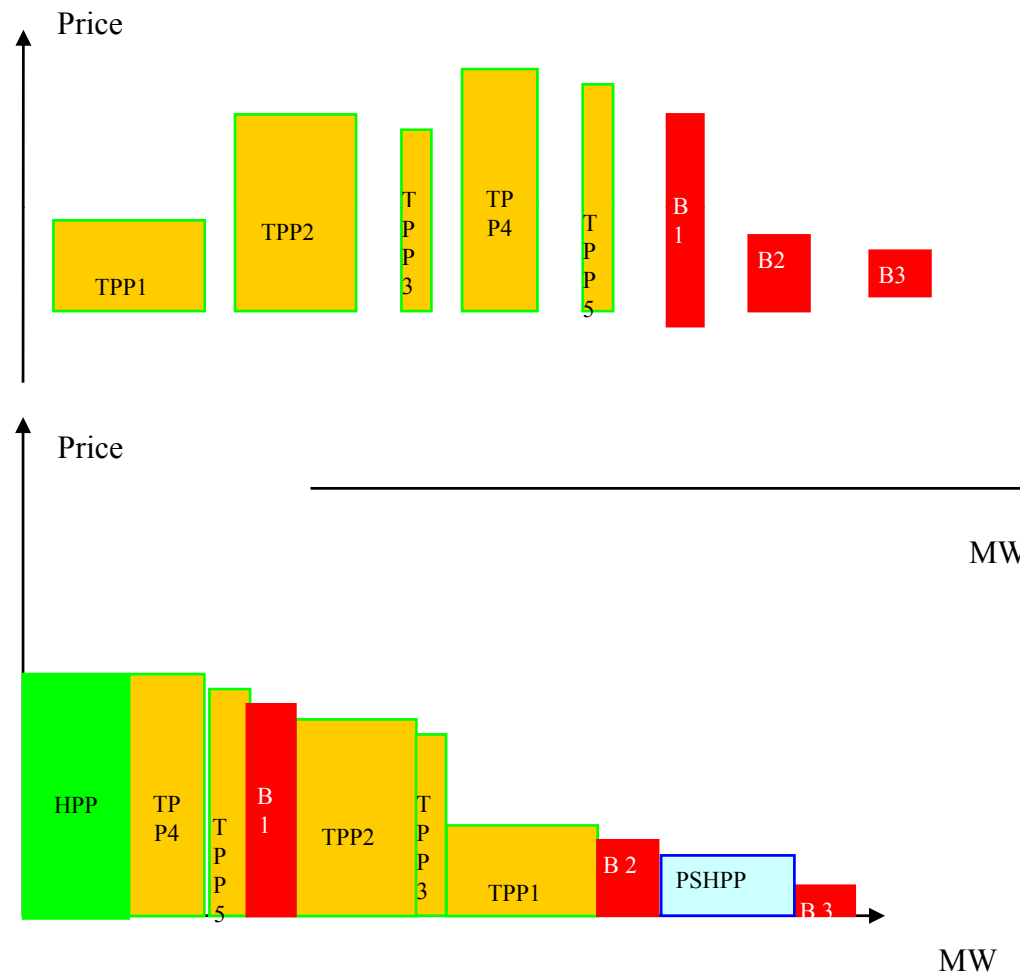
BALANCING MARKET PARTICULARITIES-4

OFFERS
(Merit order)



BALANCING MARKET PARTICULARITIES-5

BIDS
(Merit order)

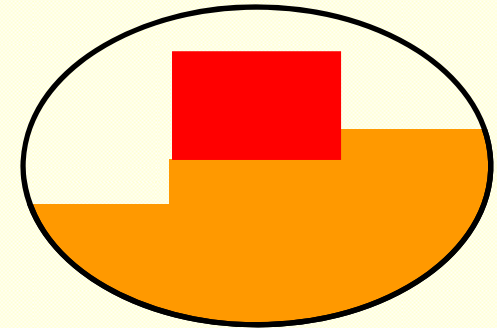


Structure and principles of the Balancing market

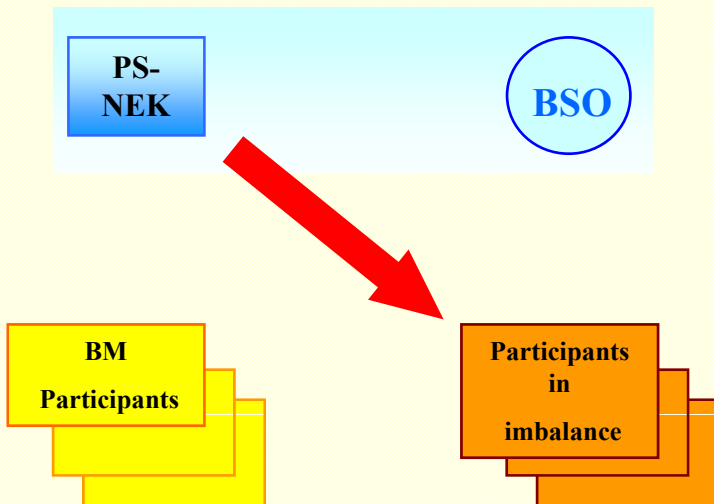


Scenarios of balancing OPC= 0

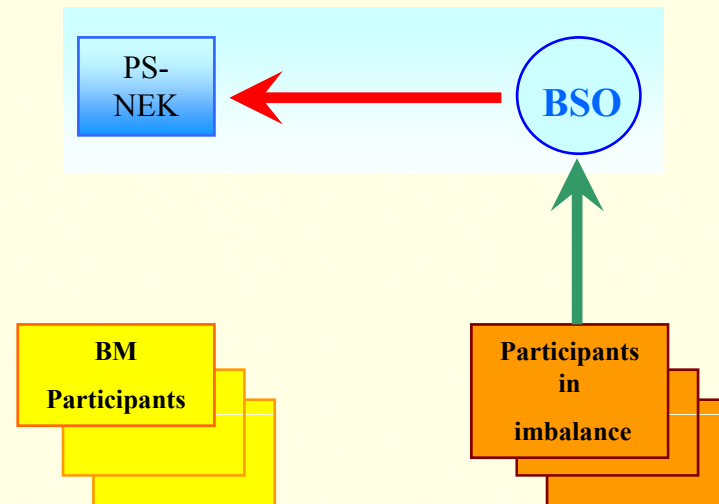
- Participant are in deficit
- According to the BM Priority List, there are no accepted Offers. The Offers Participation Coefficient (OPC) = 0
- The deficit is compensated by energy supplied only from PS-NEK



Energy Flows



Cash Flows

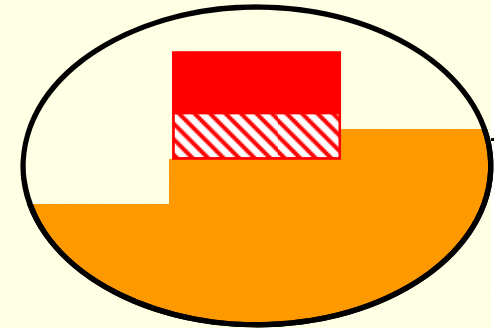


Structure and principles of the Balancing market

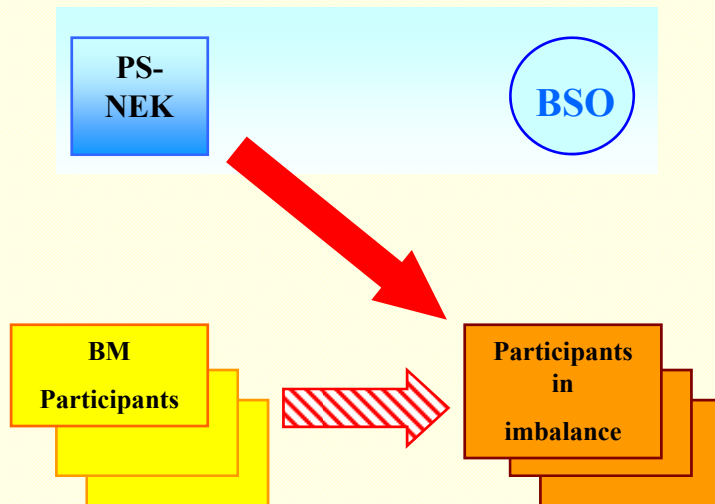
Scenarios of balancing $OPC = 0 - 1$



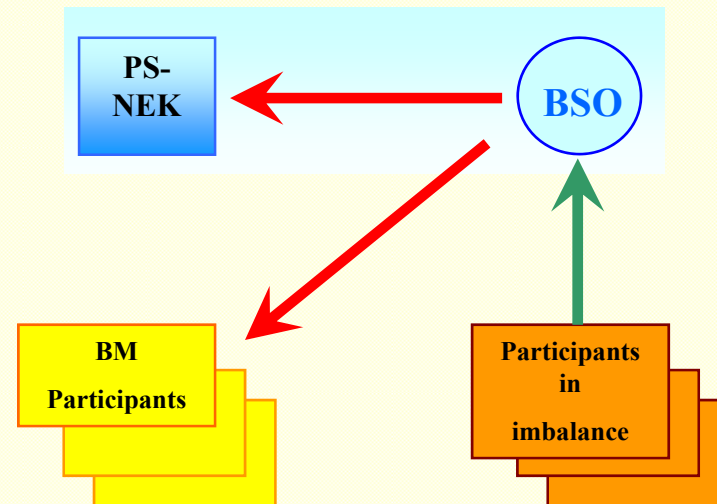
- Participant are in deficit
- According to the BM Priority List there are accepted Offers but their energy volume is lower than the Participants deficit ($OPC = 0 - 1$)
- The deficit is met by using energy partly from PS-NEK and partly from the activated Offers



Energy Flows



Cash Flows

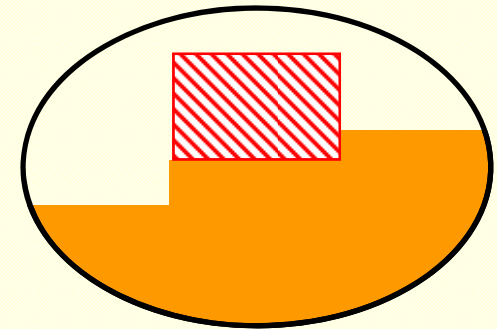


Structure and principles of the Balancing market

Scenarios of balancing $OPC = 1$

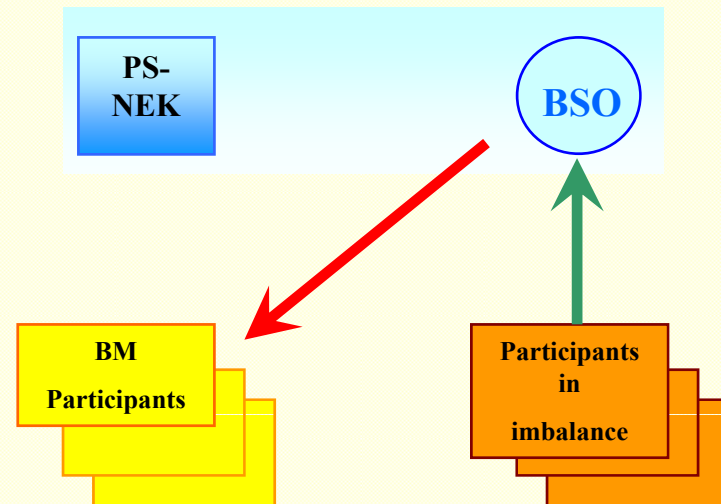
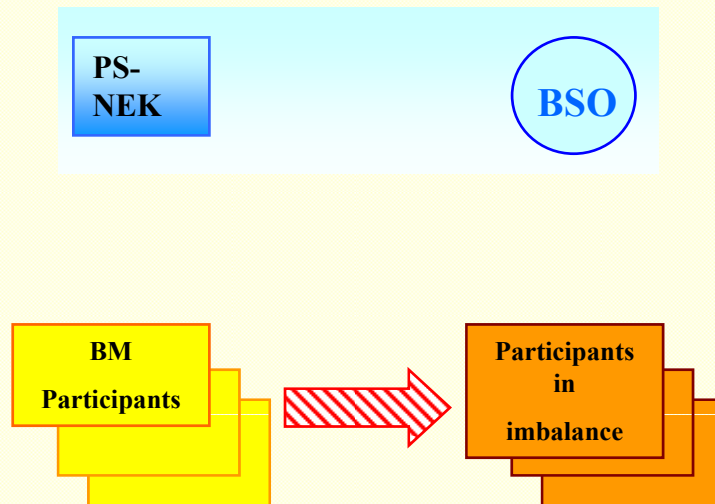


- Market Participants are in deficit
- According to the BM Priority List there are accepted Offers and their energy volume is equal to the Participant deficit $OPC = 1$
- No energy is used from PS-NEK.



Energy Flows

Cash Flows

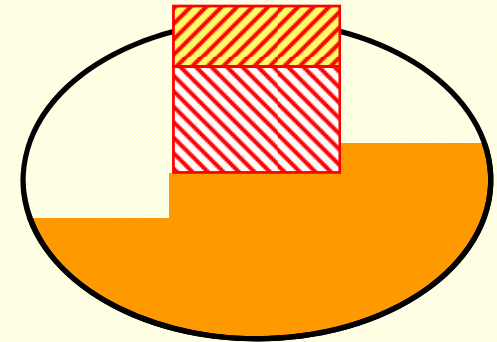


Structure and principles of the Balancing market

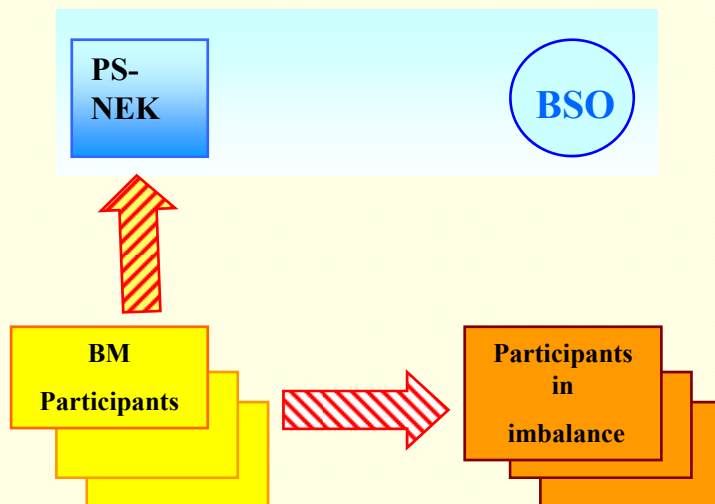
Scenarios of balancing $OPC > 1$



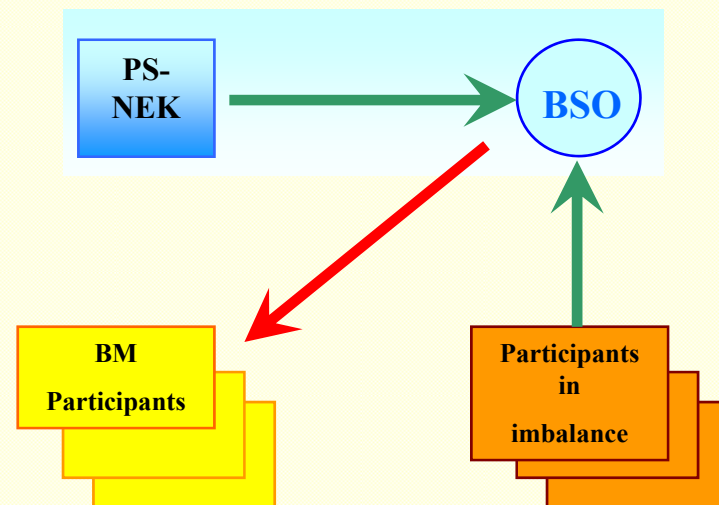
- Market Participants are in deficit
- According to the BM Priority List there are accepted Offers which energy volume is larger than the Participant deficit $OPC > 1$
- Part of the energy volume under the accepted Offers meet the imbalance in the regulated part of the market. In this case NEK-PS is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



Energy Flows



Cash Flows

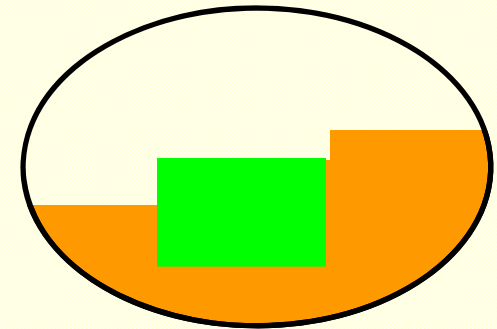


Structure and principles of the Balancing market⁺

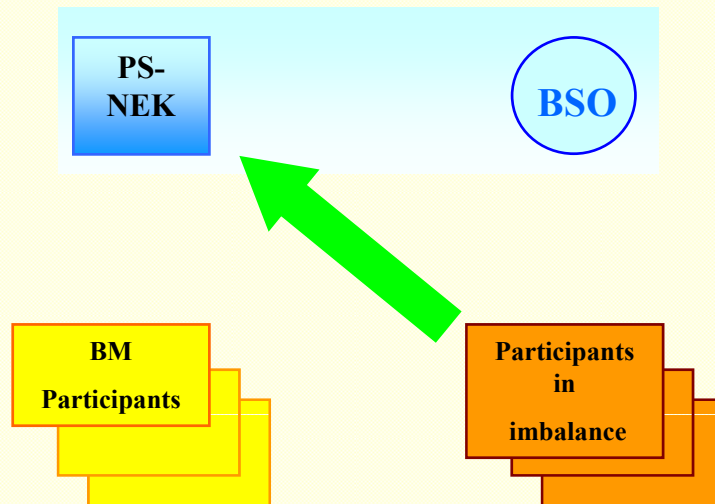


Scenarios of balancing BPC= 0

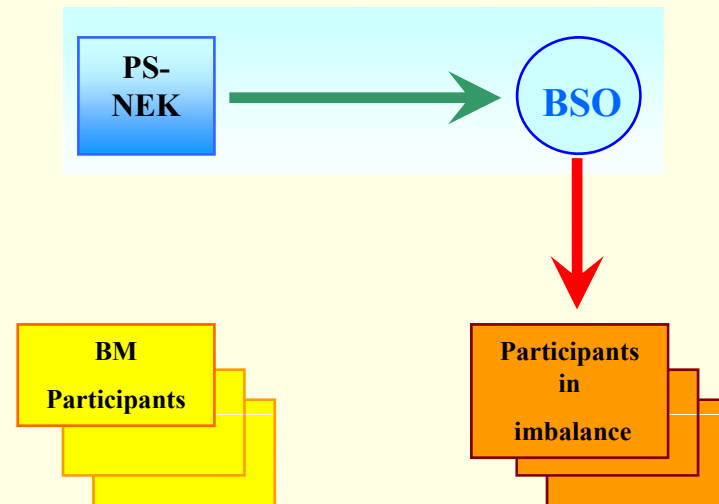
- Market Participants are in surplus
- According to the BM Priority List there are no accepted Bids. Bids Participation Coefficient (BPC) = 0
- The spill energy is compensated (purchased) only by PS-NEK.



Energy Flows



Cash Flows

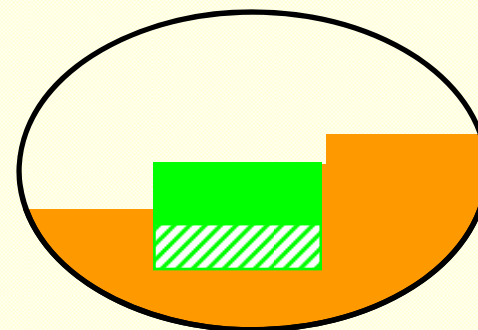




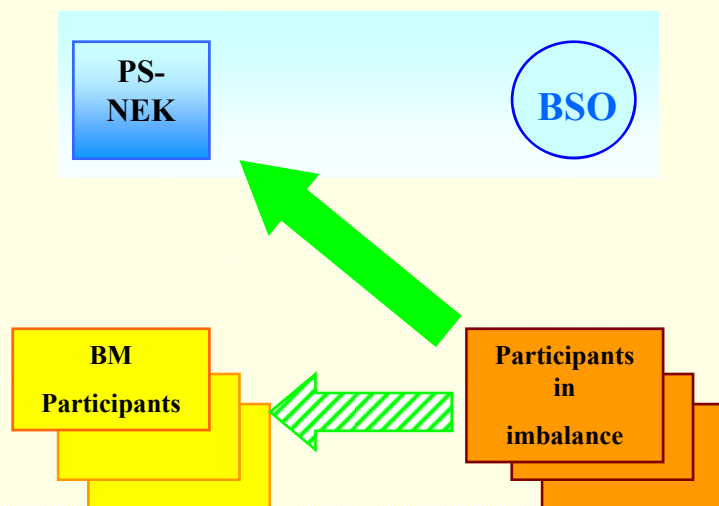
Structure and principles of the Balancing market

Scenarios of balancing $BPC = 0 - 1$

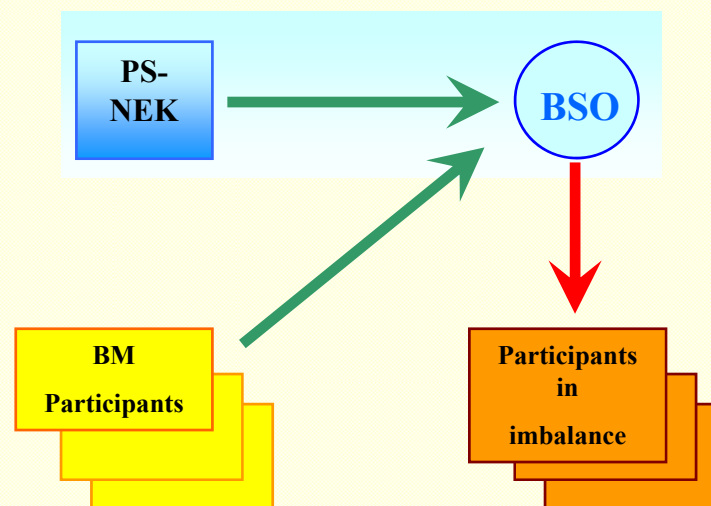
- Market Participants are in surplus
- Bids are accepted according to the BM Priority List but cannot take the entire surplus energy volume of the Participants $BPC = 0 - 1$
- The spill energy is compensated (purchased) partly by PS-NEK and partly by activated Bids.



Energy Flows



Cash Flows

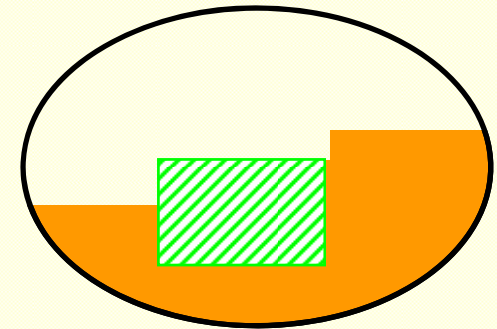


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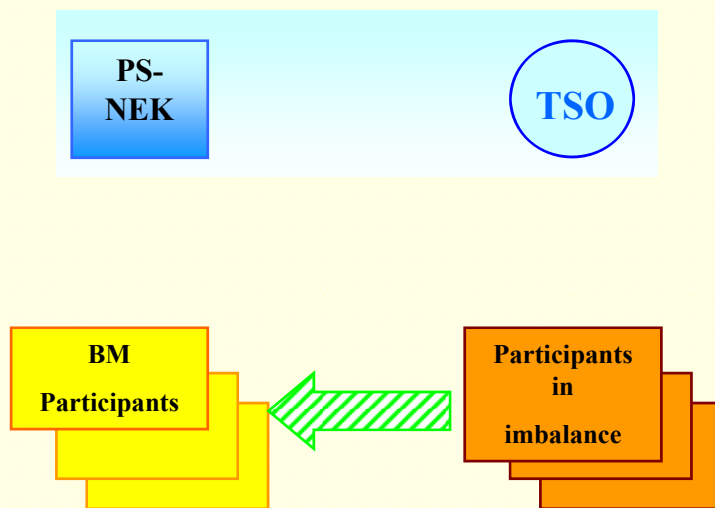


Scenarios of balancing BPC =

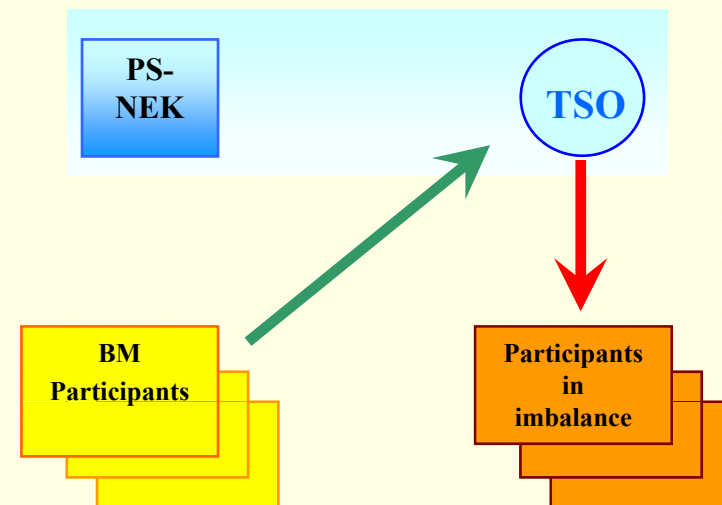
- Market Participants are in surplus
- The accepted Bids according to the BM Priority List match fully the entire surplus energy of the Participants **BPC = 1**
- PS-NEK does not compensate (purchase) any spill energy.



Energy Flows



Cash Flows

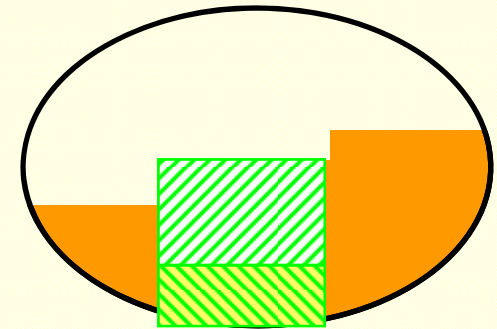


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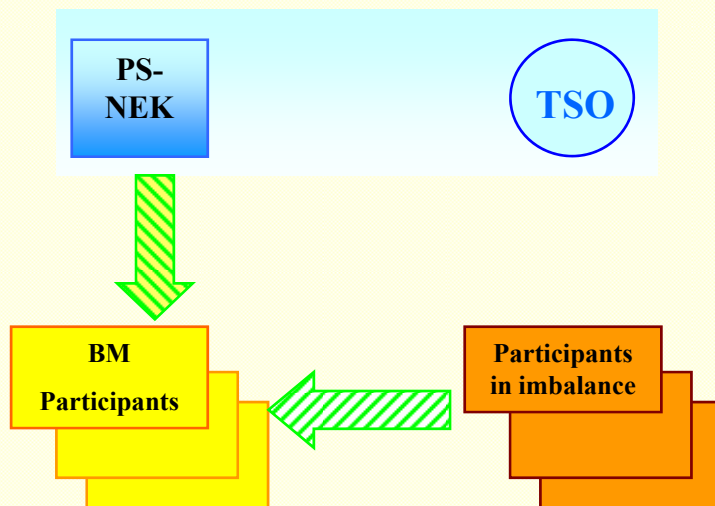


Scenarios of balancing $BPC = > 1$

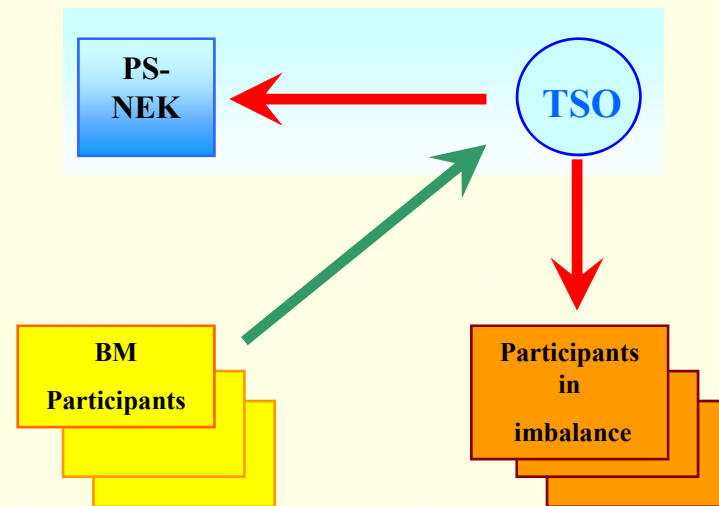
- Market Participants are in surplus
- The volume of the accepted Bids according to the BM Priority List is higher than the surplus energy from the Participants, $BPC > 1$
- The accepted Bids compensate also for part of the surplus in the regulated part of the market. In this case NEK-PS is subject to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



Energy Flows



Cash Flows



Pricing methodology

Imbalance Price – for Deficit



$$PED_j = (1-OPC_j)PEM_j + OPC_jPEO_{wghj}$$

Where:

PE_{Dj} is a Top up price for period j

PE_{Mj} 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/kWh

PE_{O_{wghj}} is a weighted average price calculated from the accepted offers in the Balancing Market for period j;



Pricing methodology

Imbalance Price – for Surplus

$$PES_j = (1 - BPC_j)PEF_j + BPC_jPEB_{wghj}$$

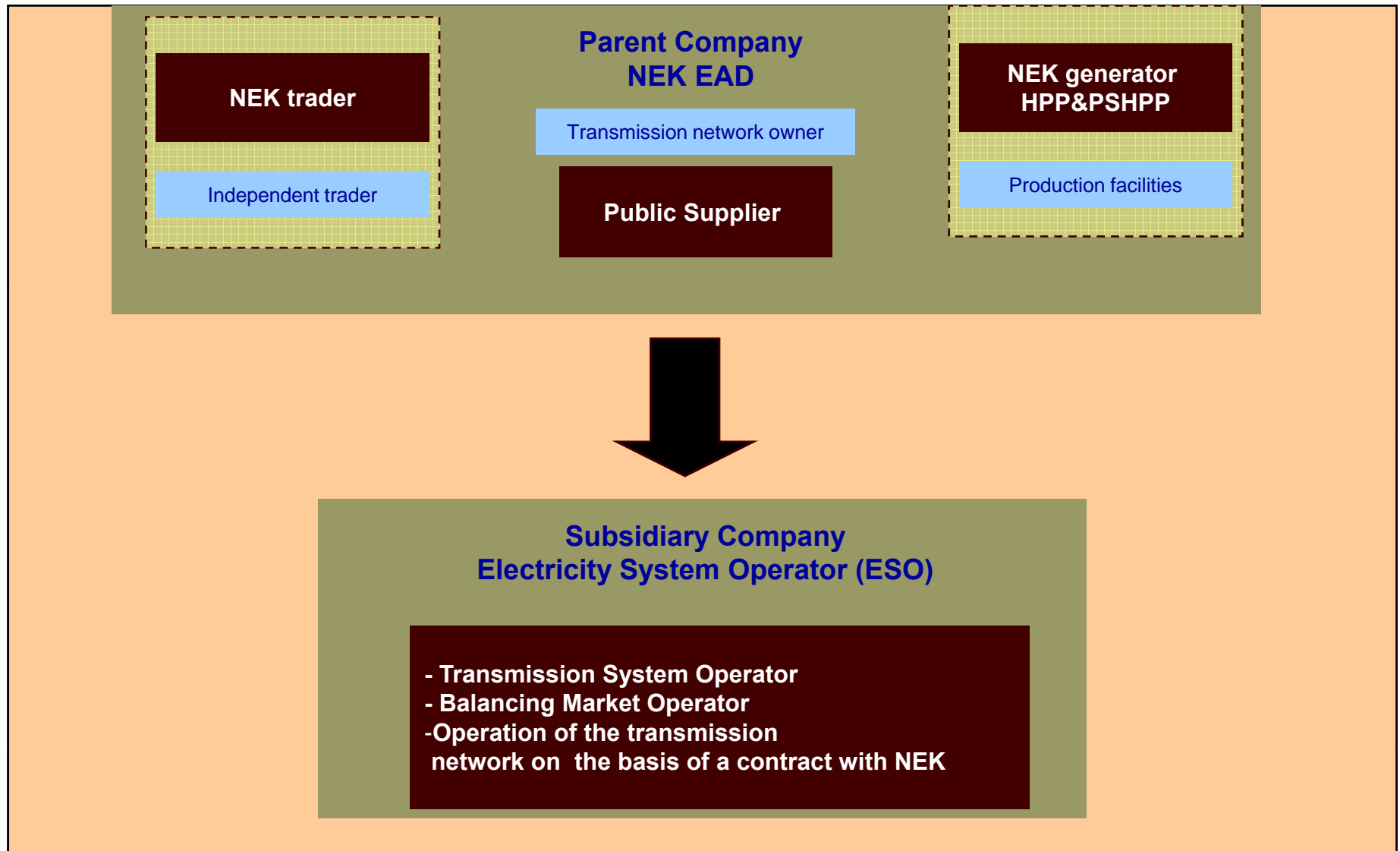
Where:

PES_j is a Spill price for period j

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

PEB_{wghj} is a weighted average price calculated from the accepted bids in the Balancing Market for period j;

BULGARIAN ELECTRICITY SYSTEM OPERATOR



BULGARIAN ELECTRICITY SYSTEM OPERATOR-2

2006

2007

NATSIONALNA
ELEKTRICHESKA
KOMPANIA

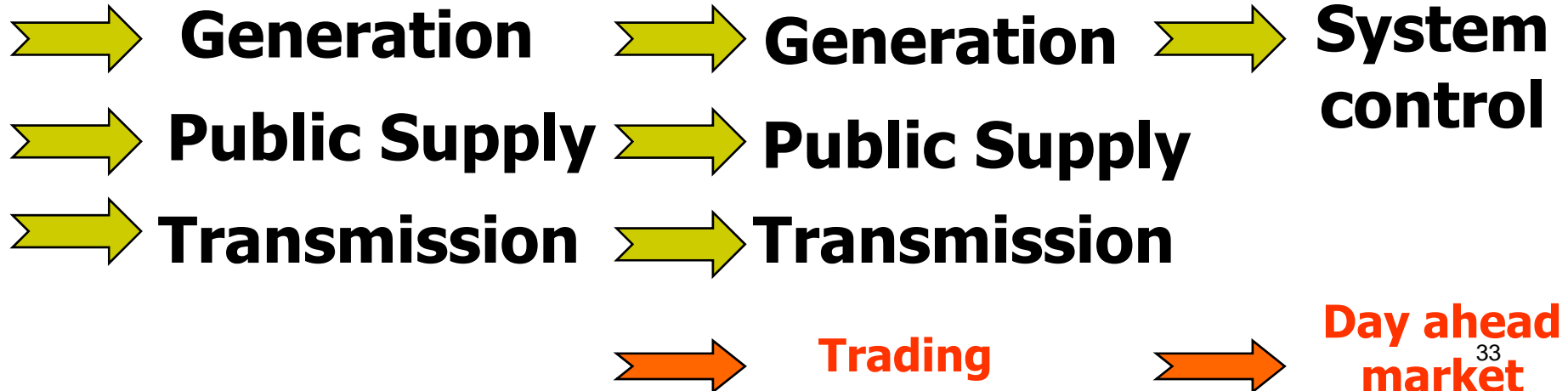
NATSIONALNA
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ELECTRICITY
SYSTEM
OPERATAR

Licenses

Licenses

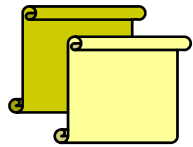
Daughter Company
100% owned by NEK



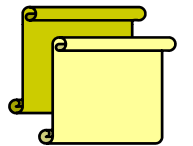
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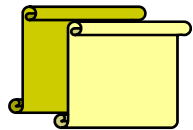
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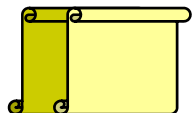
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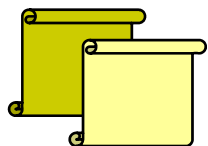
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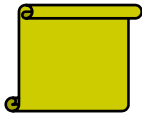


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NORMATIVE FRAMEWORK -2



Energy Law (State Gazette, issue 74/08.09.2006)

- ❖ **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 it's 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

2006

**Total number of
market participants**

23

**Total number of
registered schedules**

591

**Total traded quantity
to end customer**

2 607 023 MWh

Transactions via traders

104 449 MWh (3.85%)

**Total number of market
participants**

51

**Total number of
registered schedules**

1320

**Total traded quantity
to end customer**

3 214 552 MWh

Transactions via traders

925 479 MWh (28%⁹)

MARKET OPERATION

2005

2006

Total Deficit

43 214 MWh (1.65%)

Total Deficit

69 358 MWh (2.15%)

Total Surplus

247 389 MWh (7.5%)

Total Surplus

184 670 MWh (5.7%)

Activated Offers

4 offers for 44 MWh

Activated Offers

0

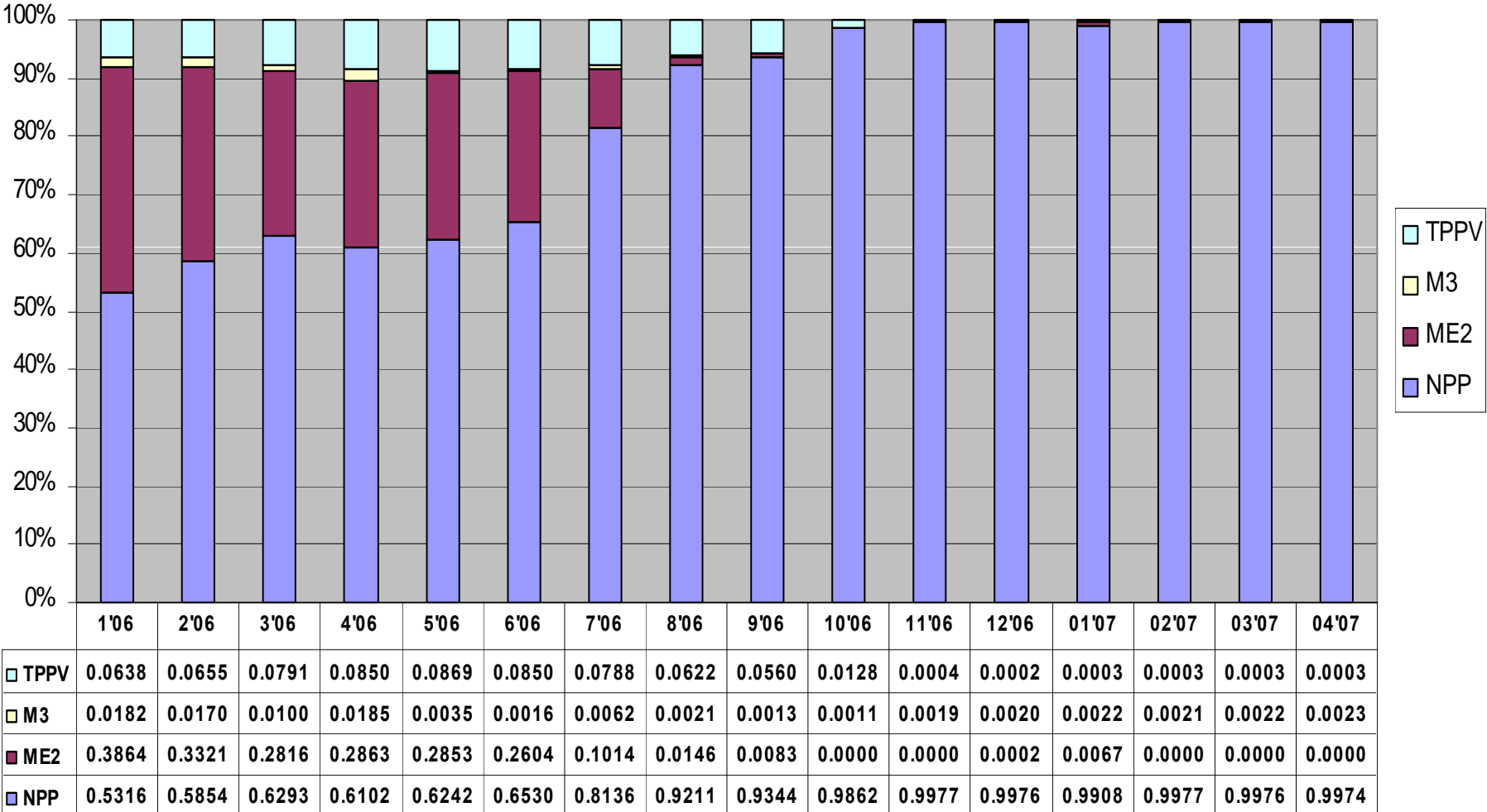
Activated Bids

3 bids for 281 MWh

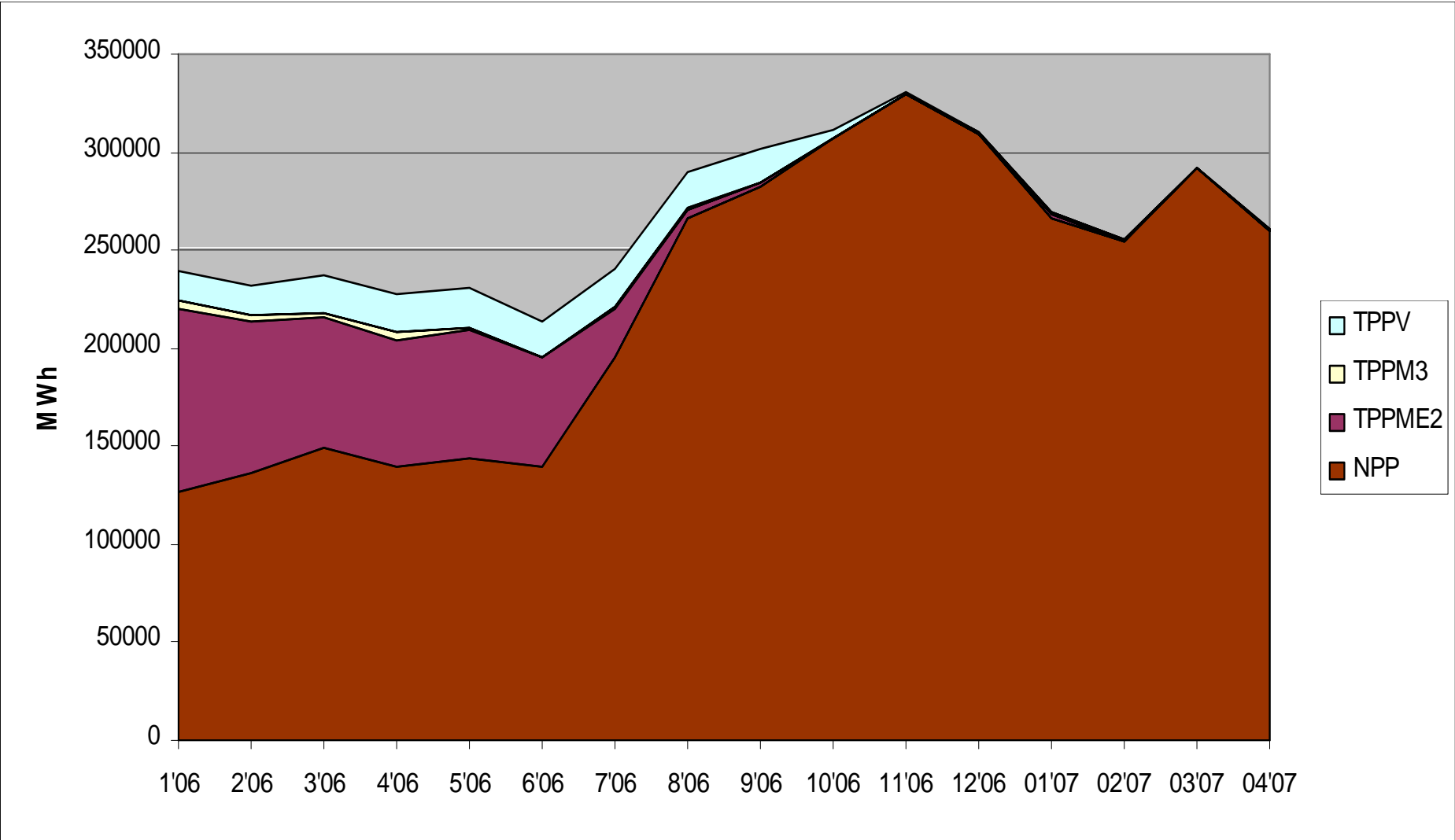
Activated Bids

0

PARTICIPATION OF THE GENERATORS IN THE OPEN MARKET

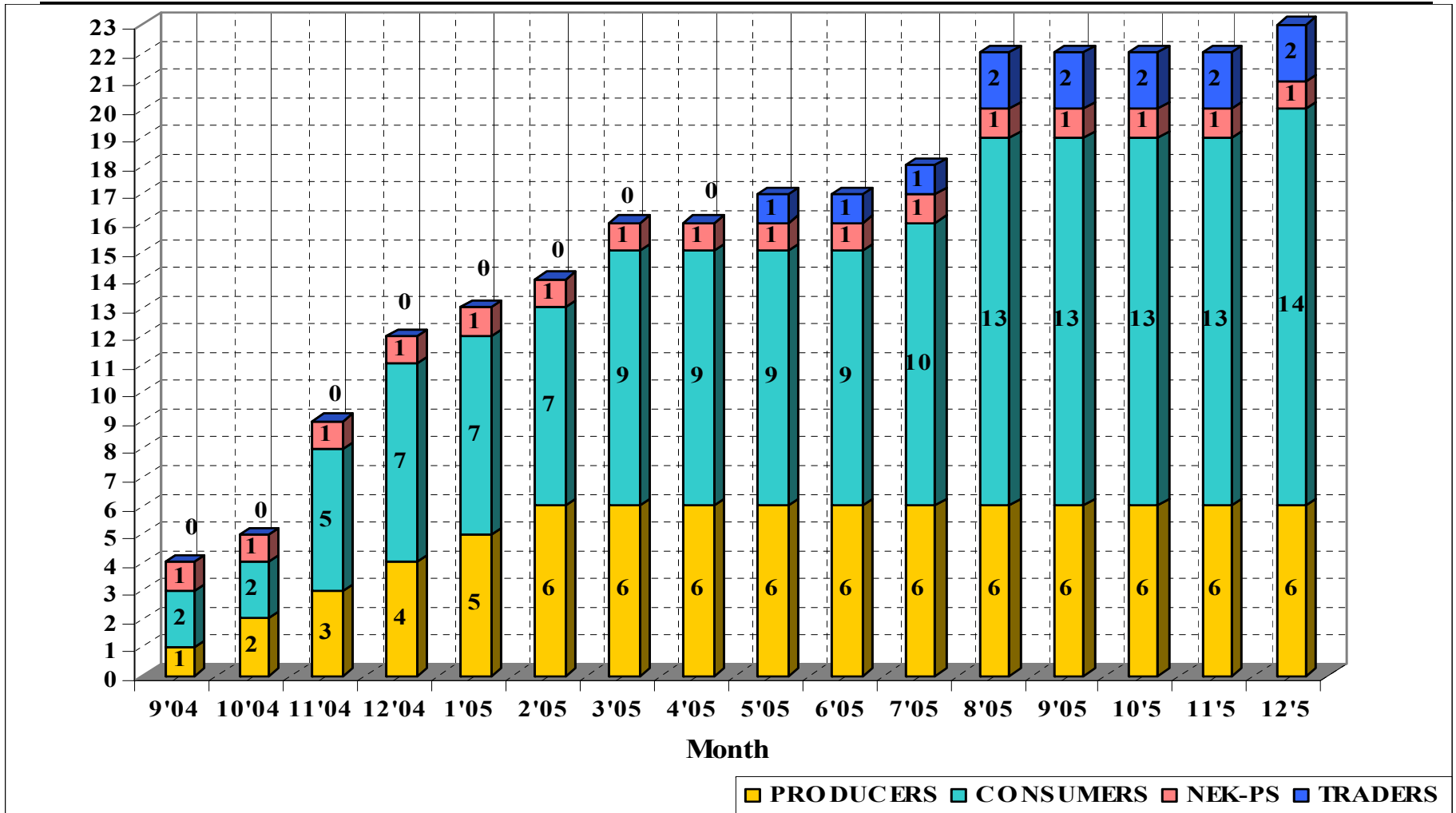


PARTICIPATION OF THE GENERATORS IN THE OPEN MARKET



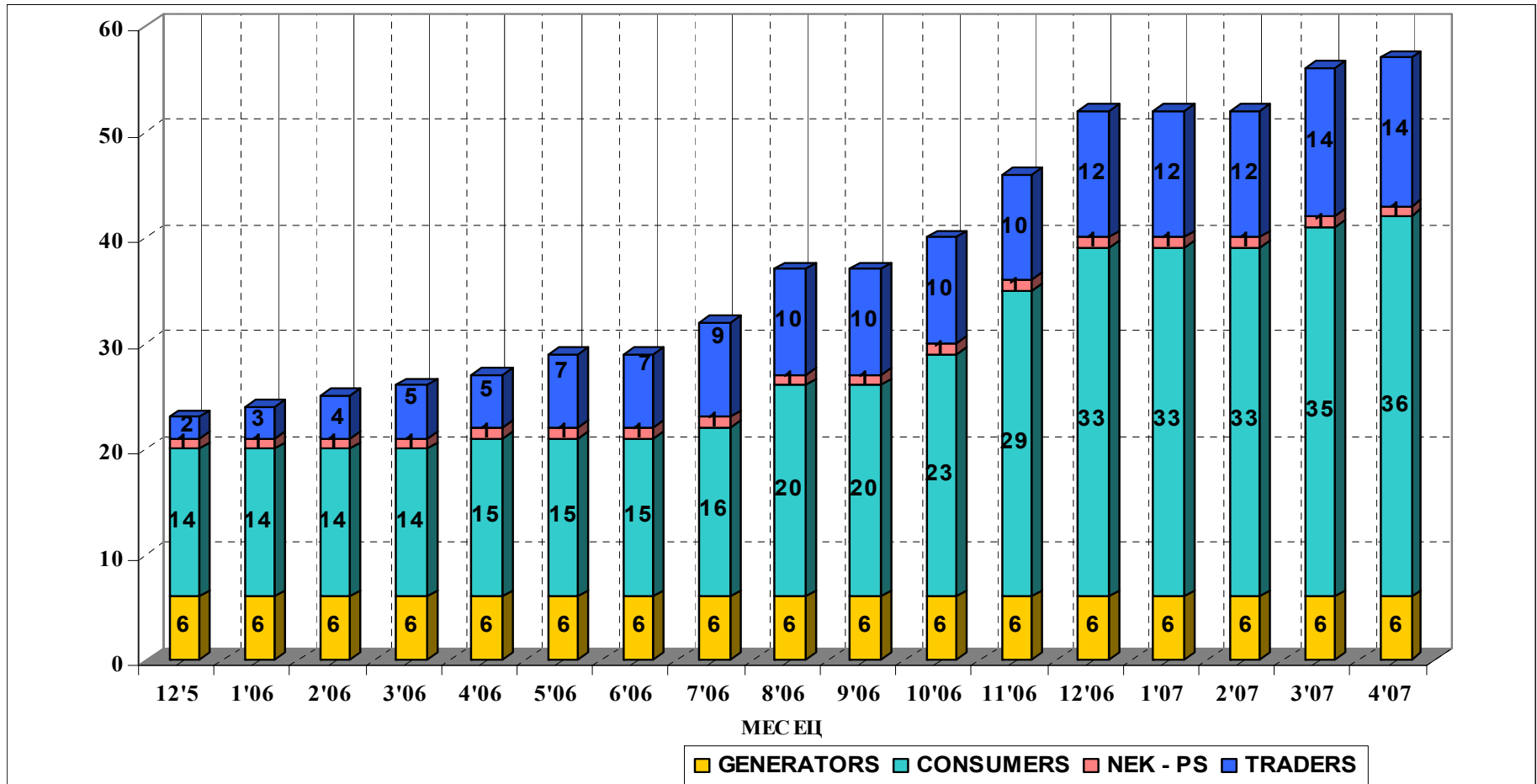
REGISTER OF MARKET PARTICIPANTS

September 2004 - December 2005



REGISTER OF MARKET PARTICIPANTS

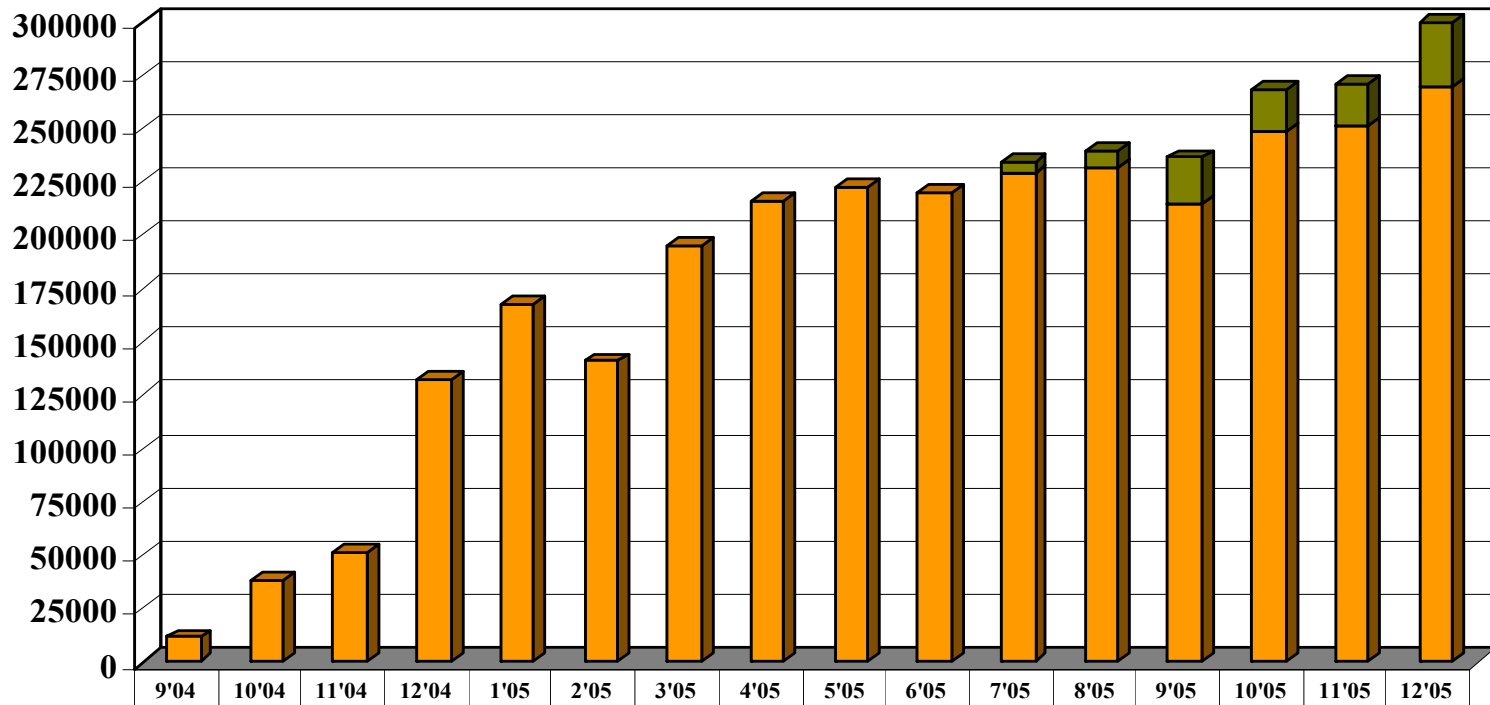
December 2005 – April 2007



BILATERAL CONTRACT MARKET

Monthly Quantities traded at freely negotiated prices

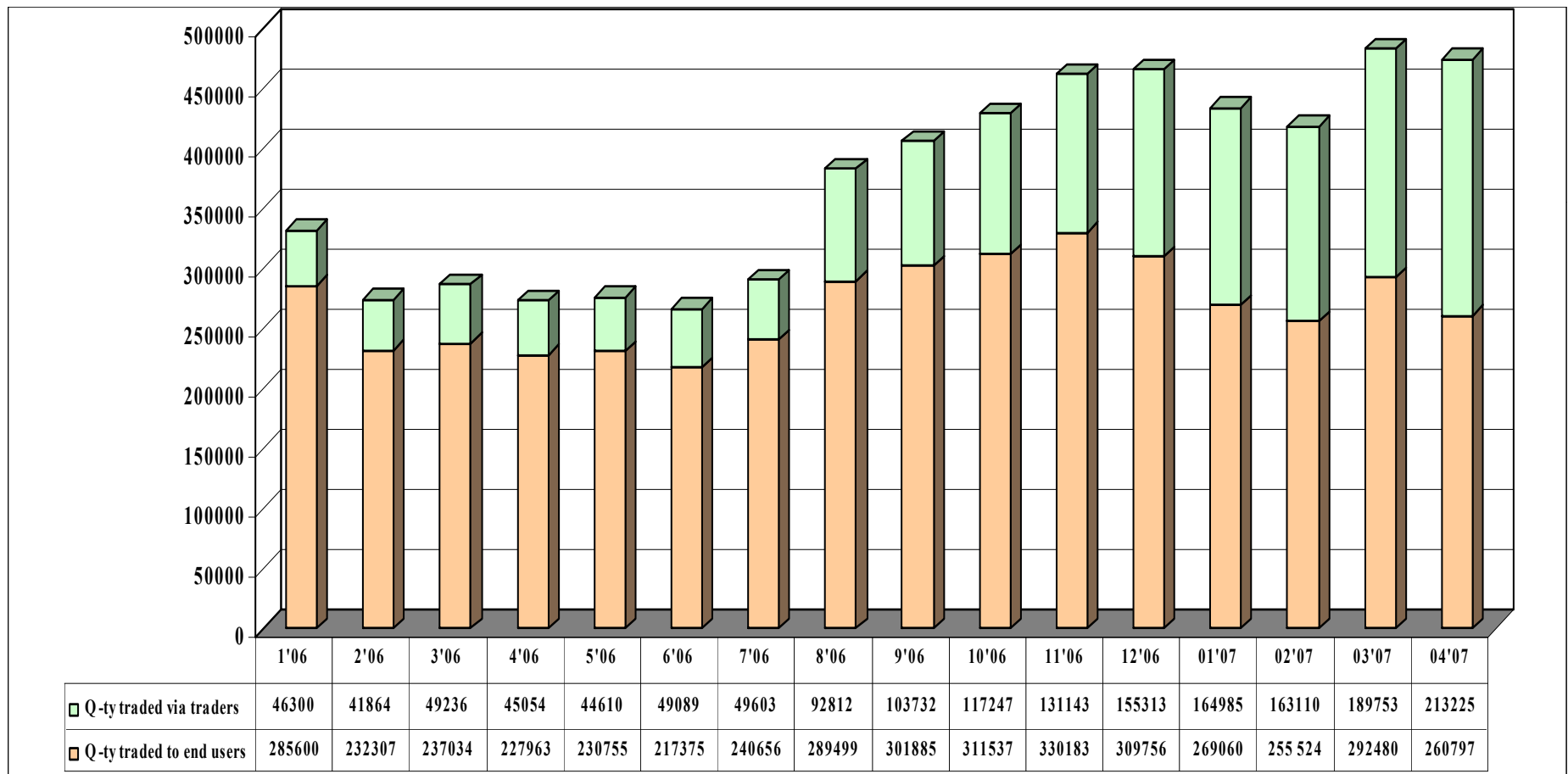
Monthly contracted quantities of electricity, MWh



■ Q -ties traded via traders											5322	8301	21237	19056	20414	30255
■ Q -ties traded to end customers	11472	38410	50747	131754	167901	140873	195459	215407	222106	220302	228853	231564	214998	249262	250687	269611

BILATERAL CONTRACT MARKET

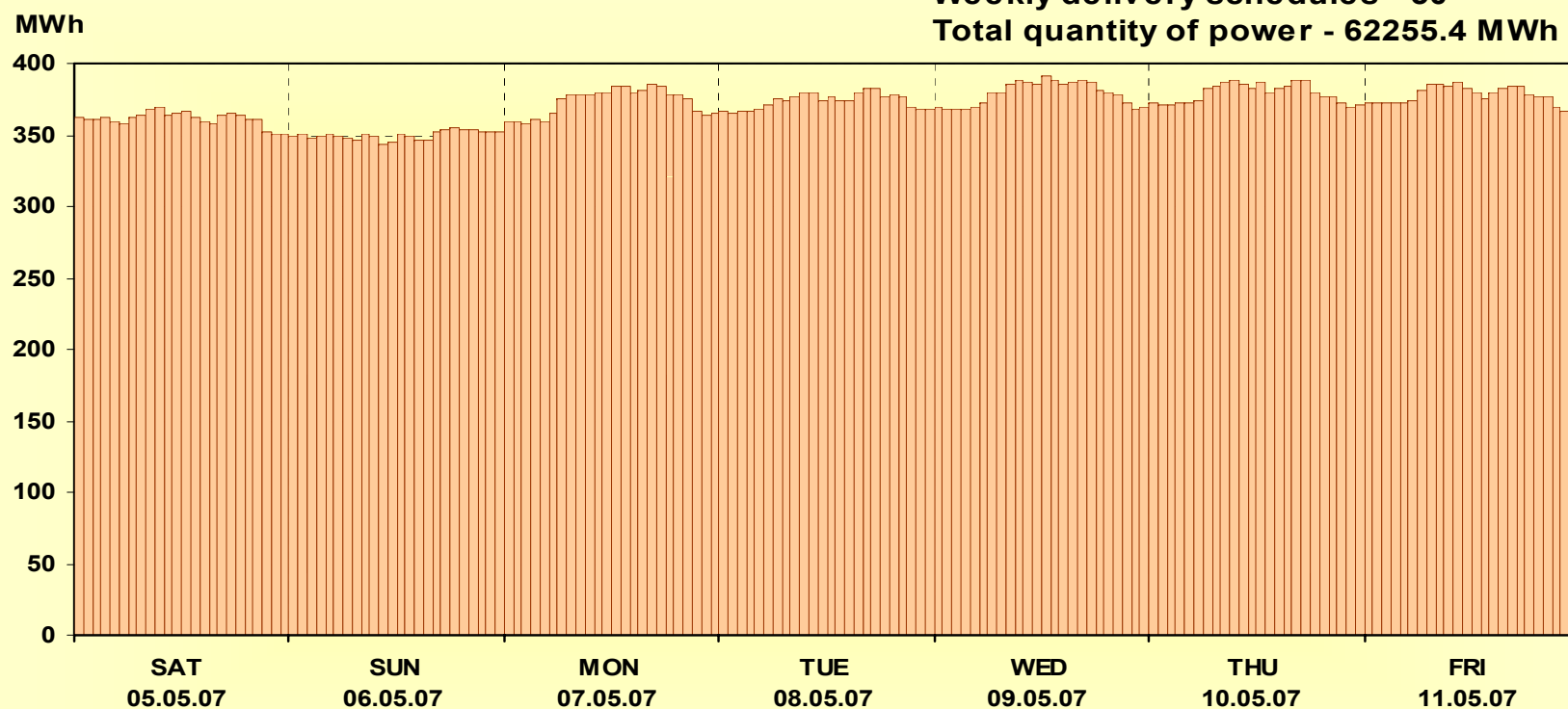
Monthly Quantities traded at freely negotiated prices



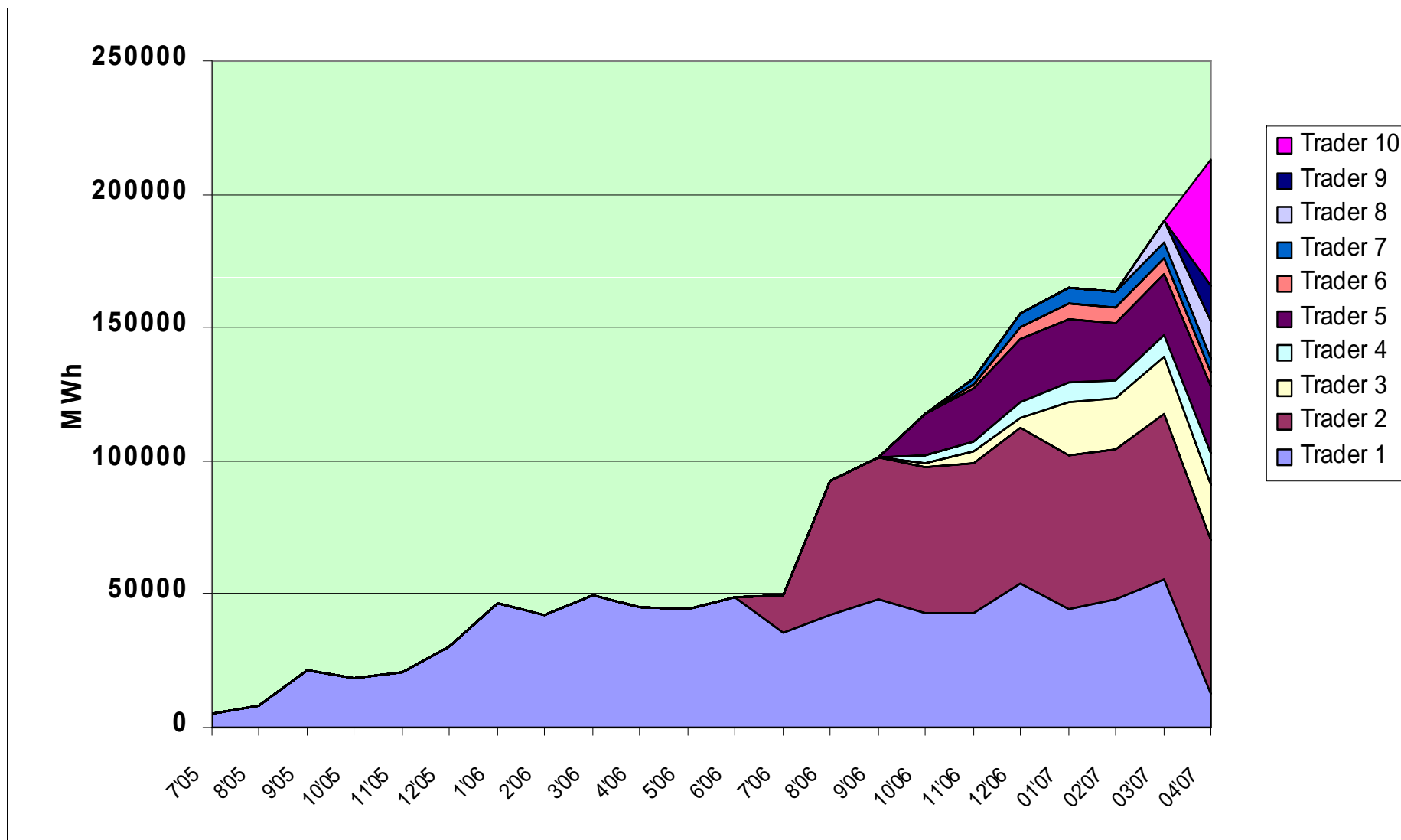
BILATERAL CONTRACT MARKET

05 - 11 May 2007

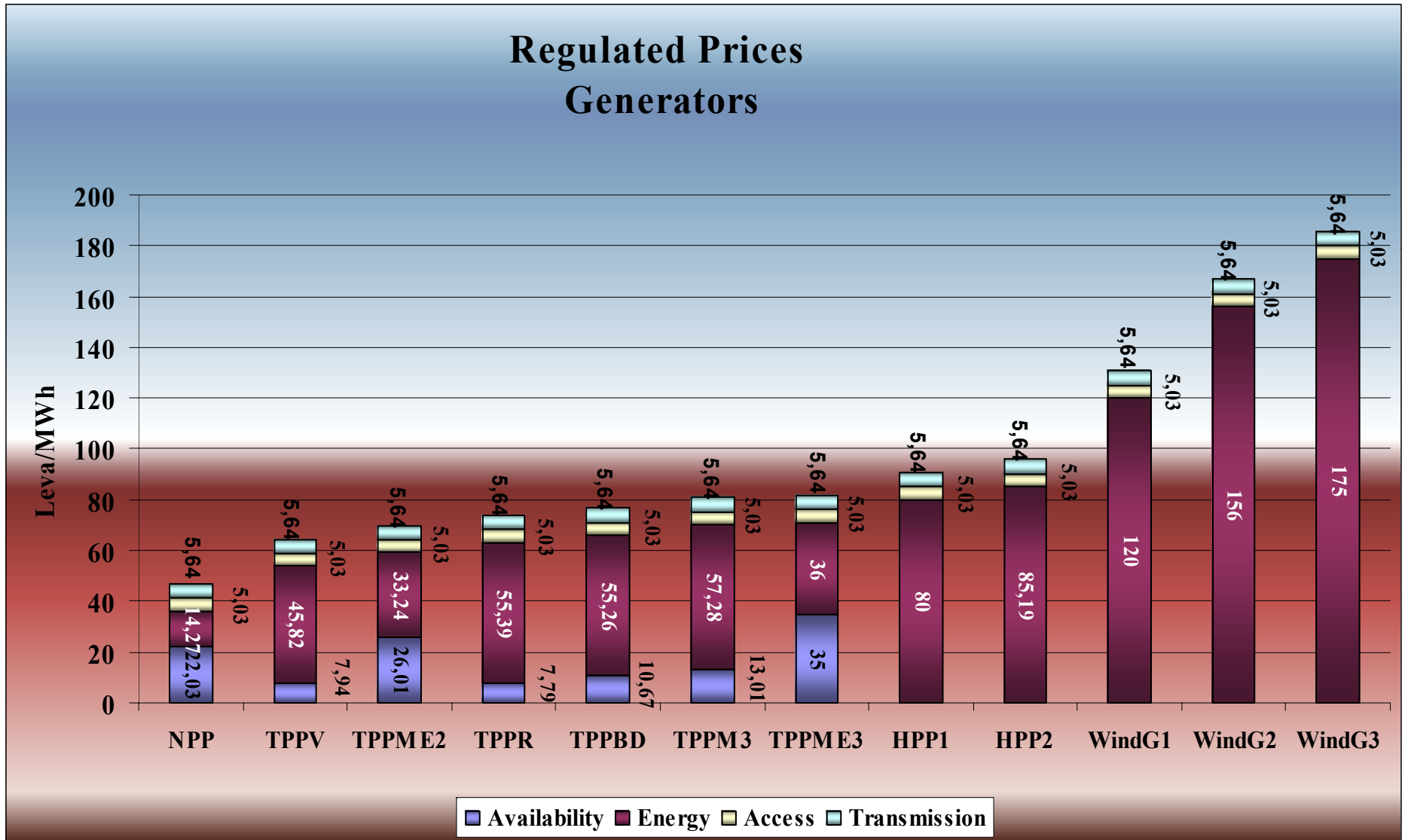
Weekly delivery schedules - 50
Total quantity of power - 62255.4 MWh



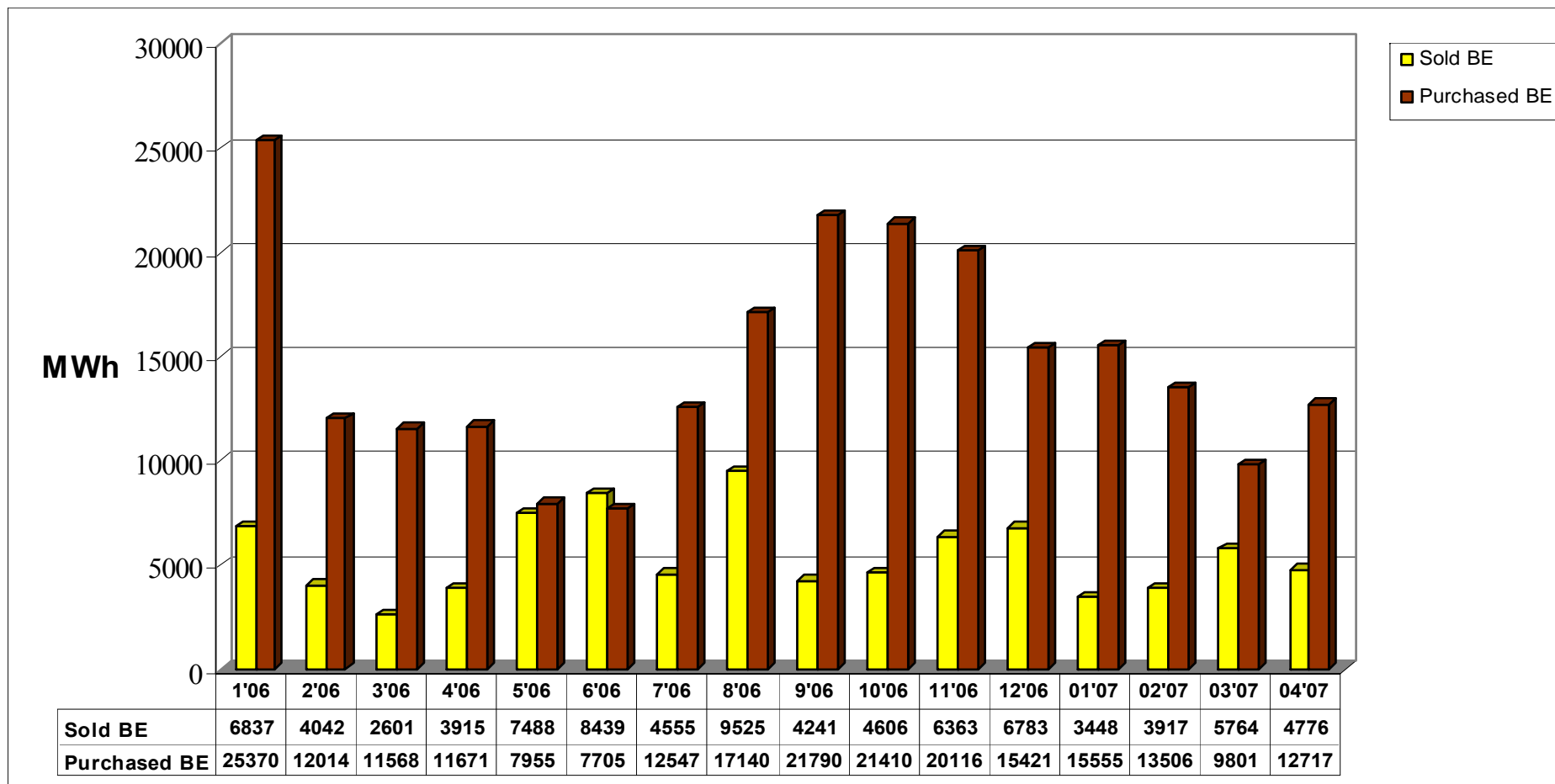
PARTICIPATION OF TRADERS IN THE OPEN MARKET



REGULATED PRICES APPROVED BY SEWRC



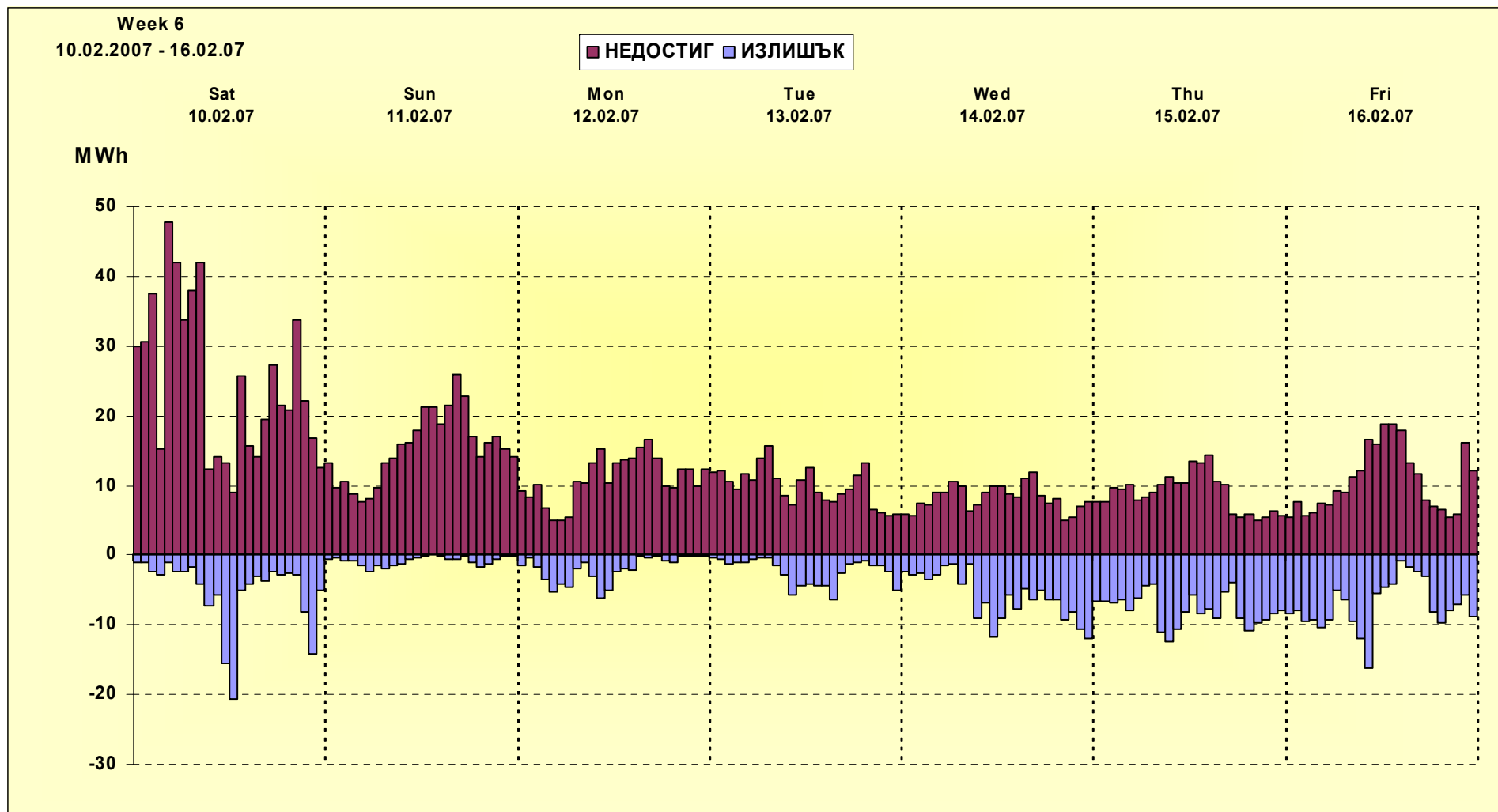
PARTICIPATION OF NEK – PUBLIC SUPPLIER IN THE BALANCING MARKET



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

BALANCING MARKET

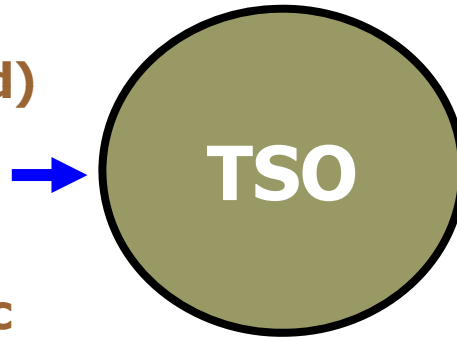
TOTAL HOURLY IMBALANCES



BALANCING MARKET

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



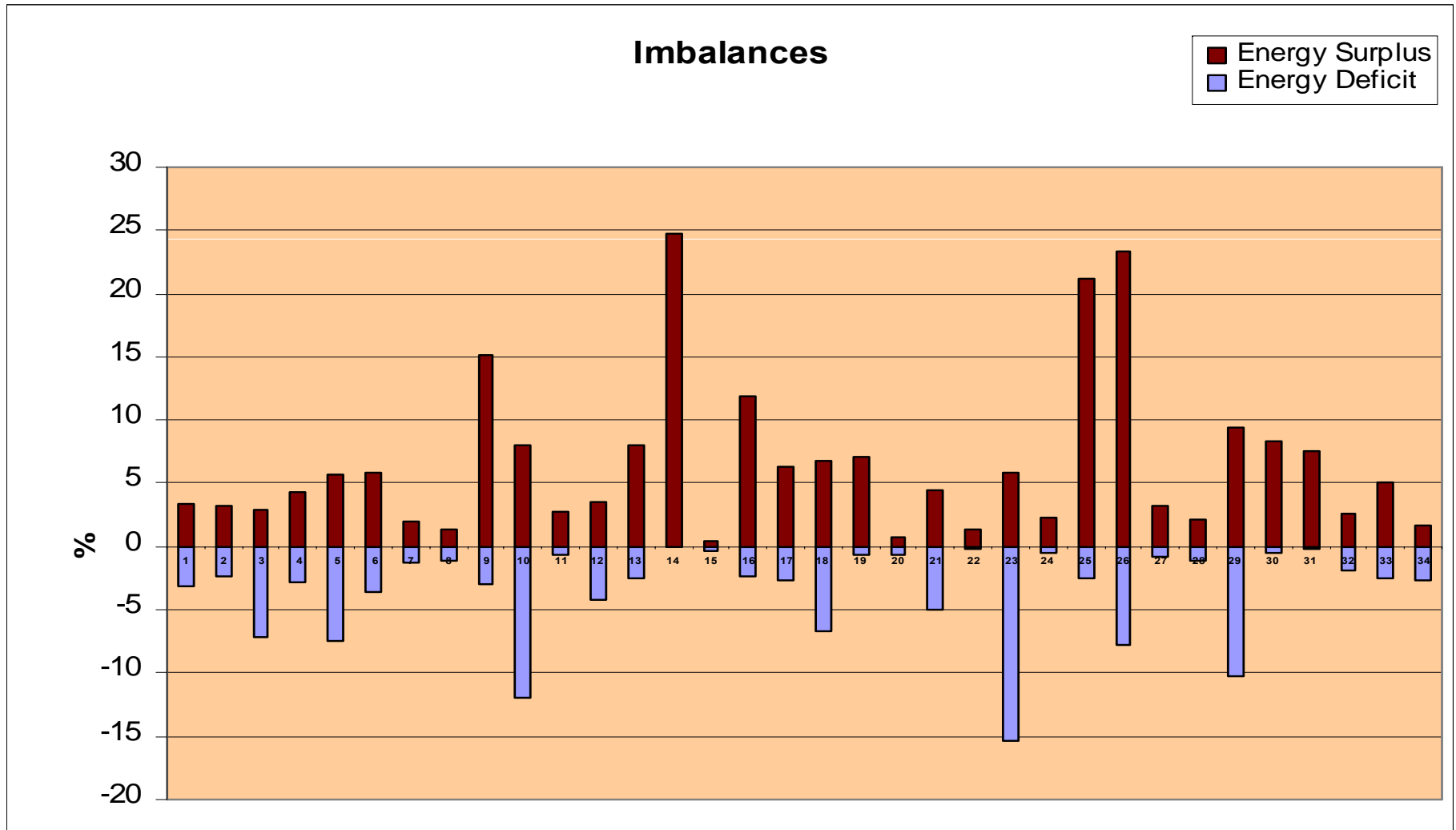
Debts of the TSO:

- 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

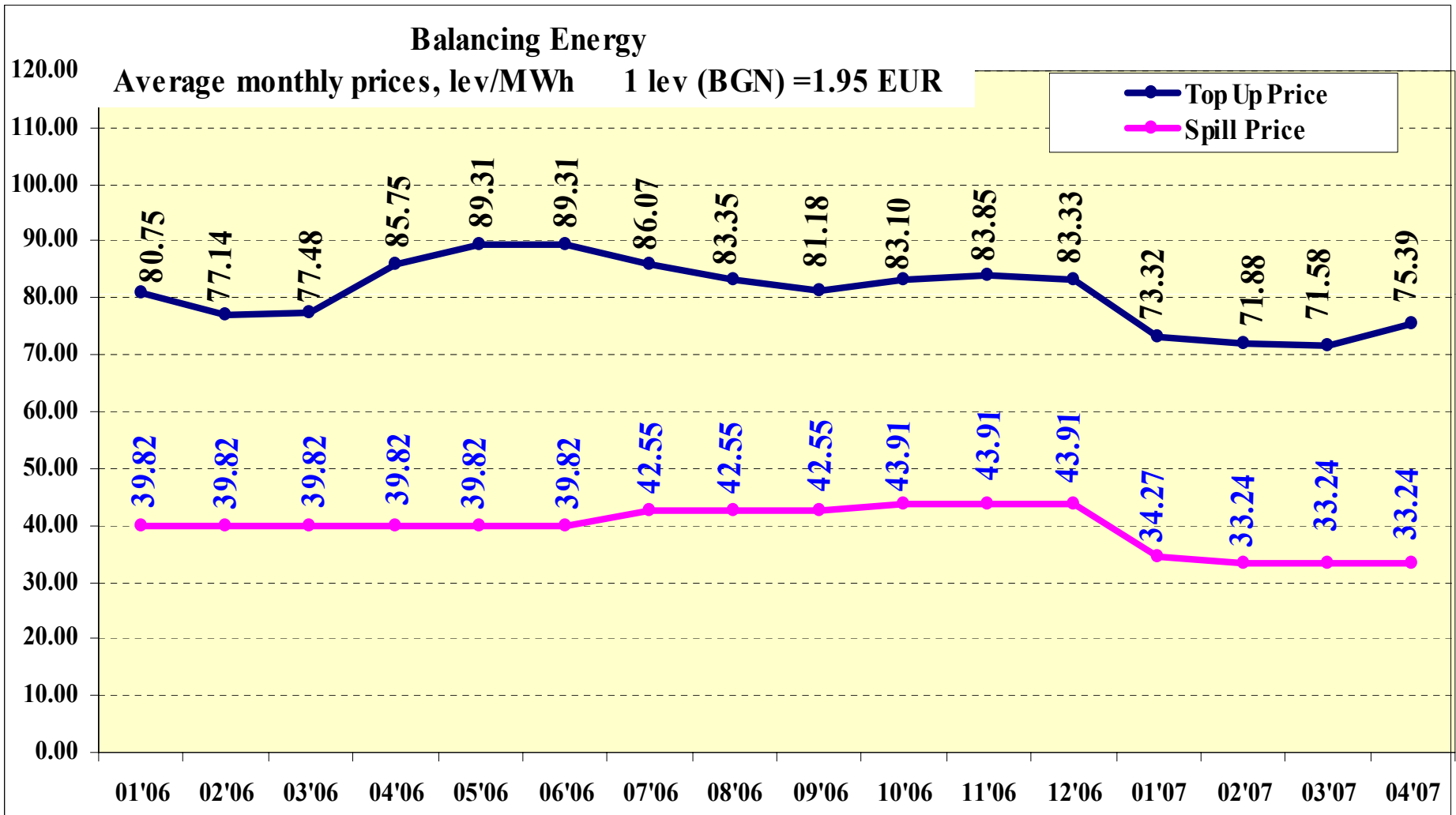
Credits of the TSO = Debits of the TSO (in every period)

BALANCING MARKET

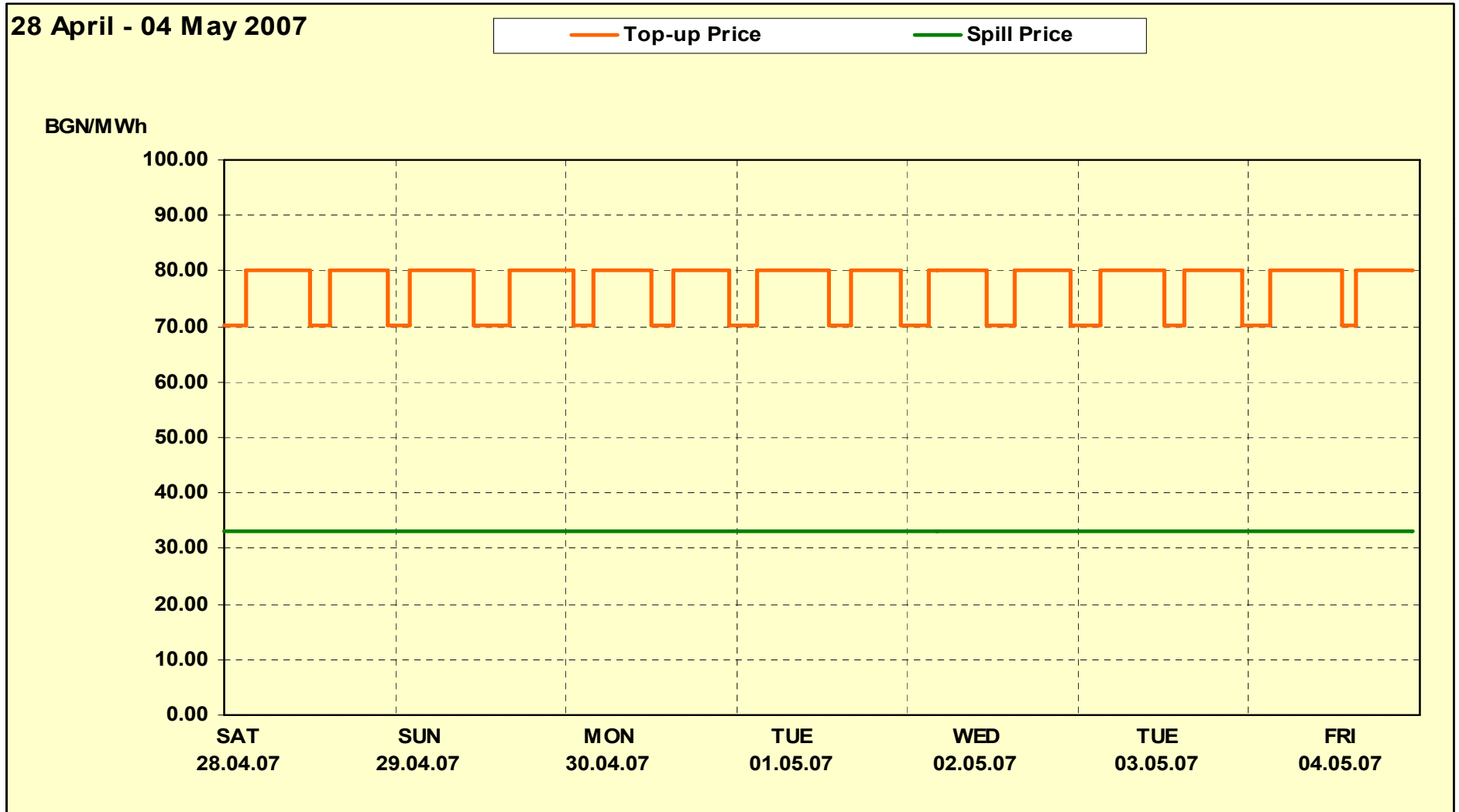
APRIL 2007



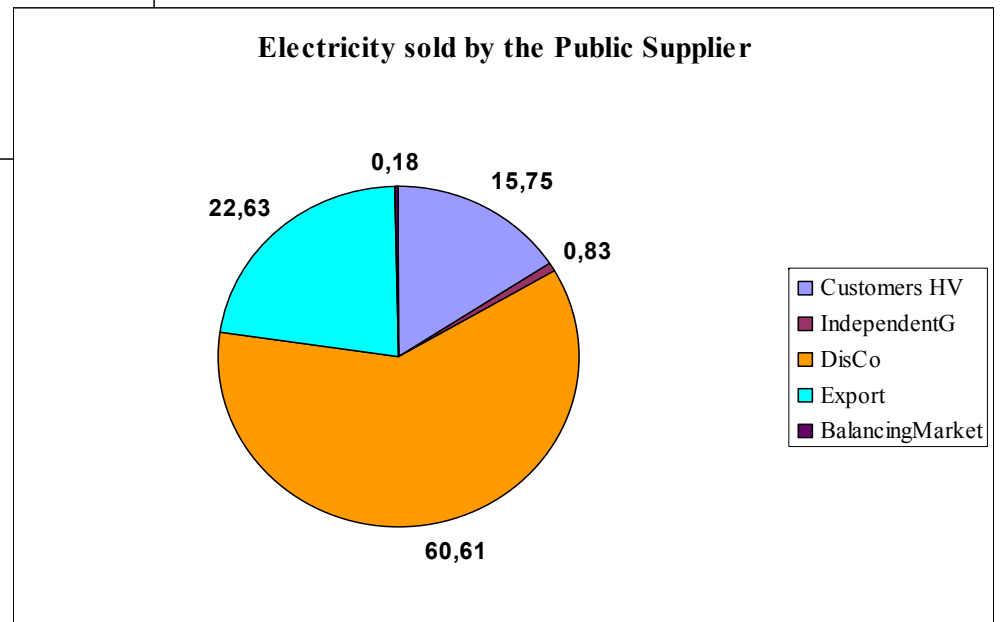
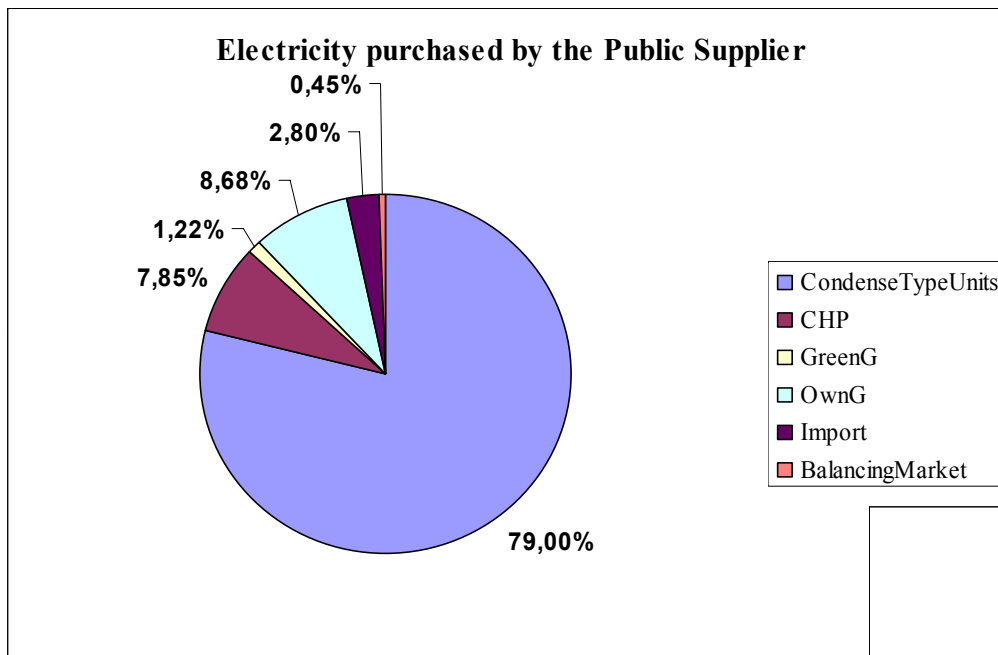
BALANCING ENERGY PRICES -1



BALANCING ENERGY PRICES -2

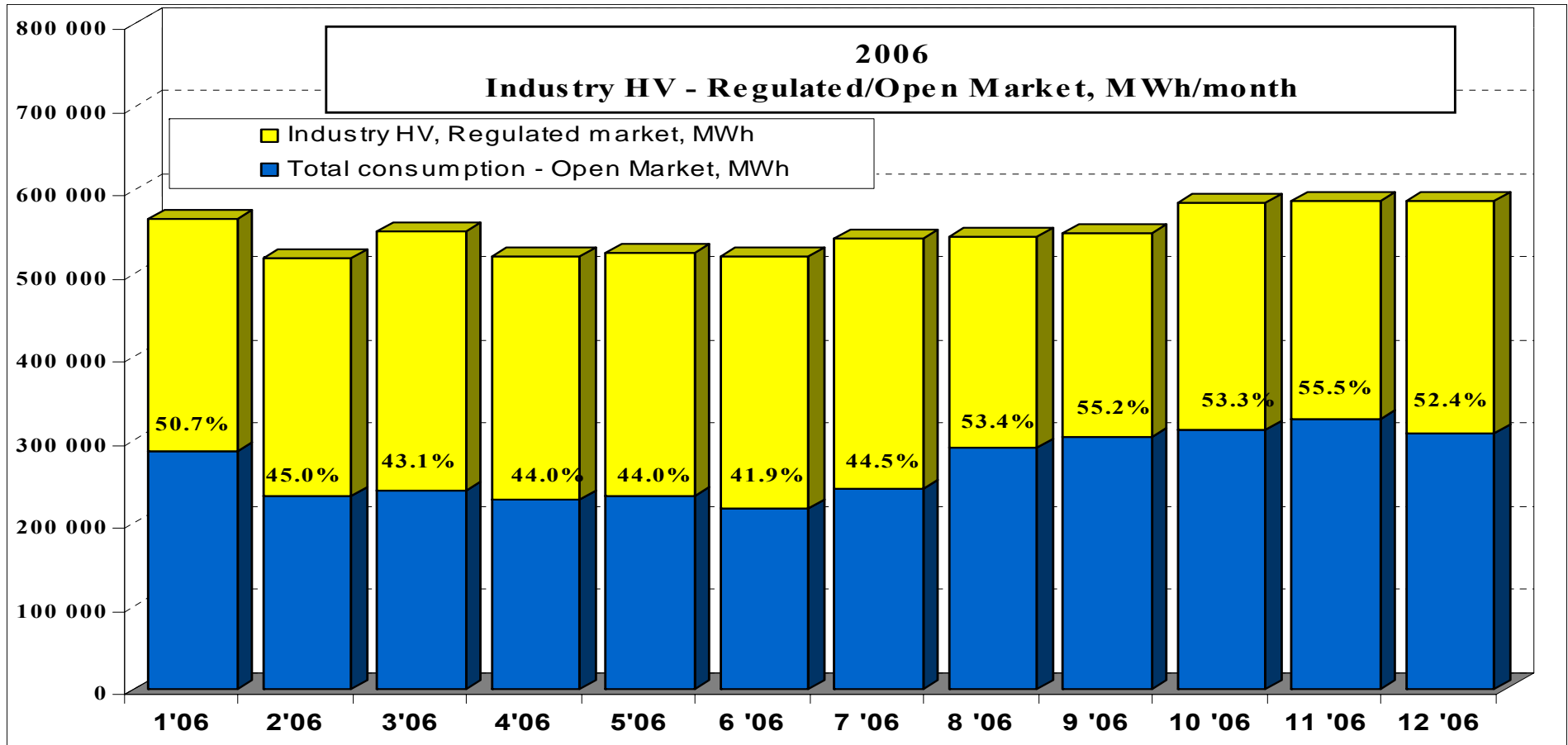


STRUCTURE OF THE PURCHASED AND SOLD ELECTRICITY BY NEK IN 2006



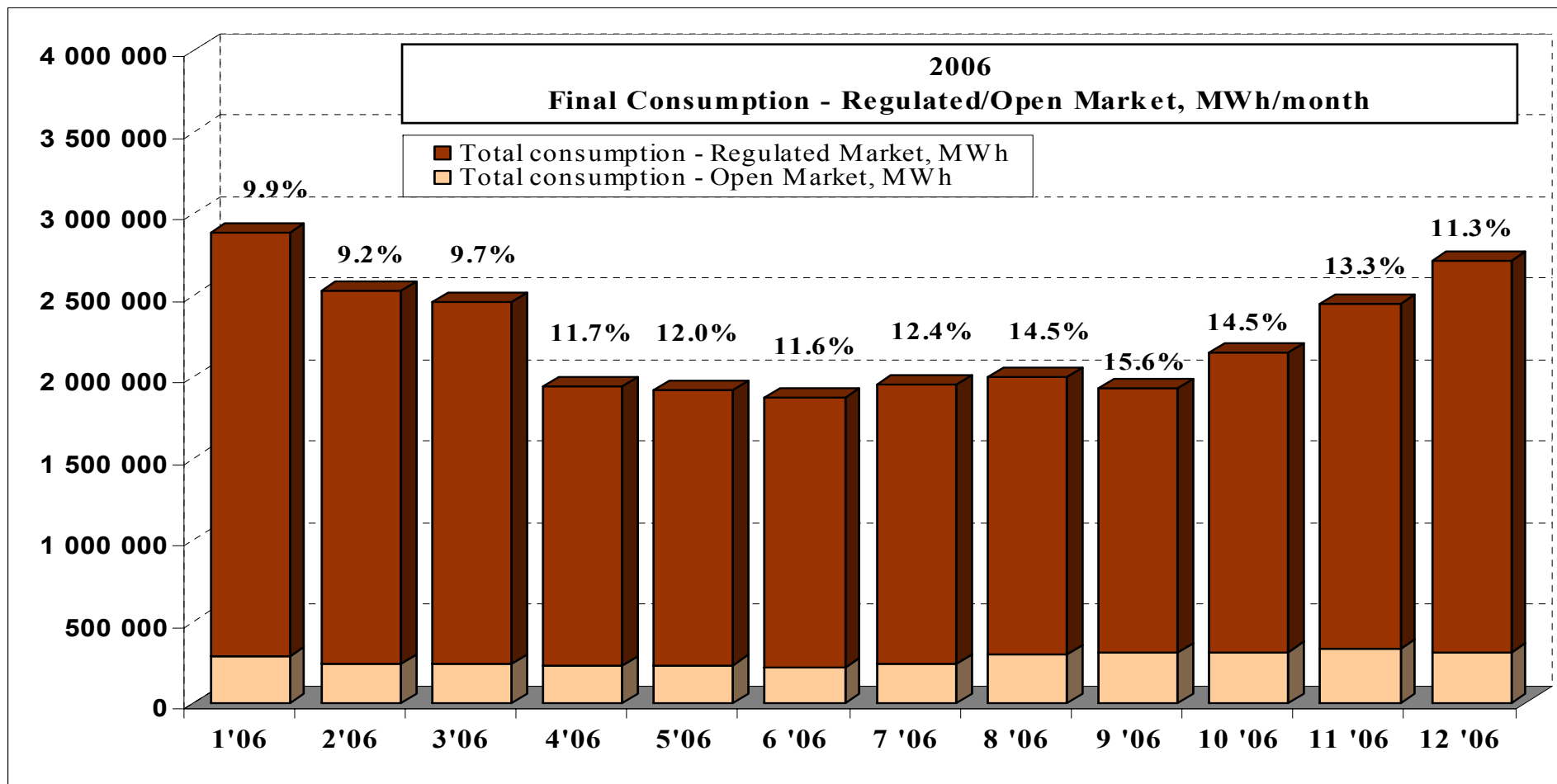
MARKET OPERATION

Proportion of regulated market demand to non-regulated market demand for HV customers



MARKET OPERATION

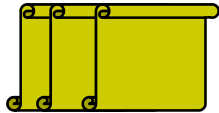
Proportion of total regulated market demand to non-regulated market



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**

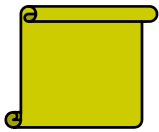
NORMATIVE FRAMEWORK - 4



New Market Rules from 01.01.2008 (in a process of development)

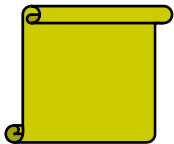
- ❖ **The Registration of Hourly Schedules for Supply of Electricity will be organized on a Daily Basis for all Transactions – Regulated and Market based**
- ❖ **Introduction of Balance Group Arrangements**
- ❖ **Development of Rules for Calculation of Imbalances of Standard and Special Balance Groups**
- ❖ **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

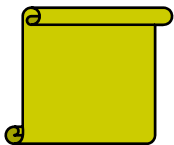


Liberalization of the market for Generators

(Hourly commitments within the working capacity range)

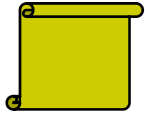


Introduction of hourly schedules in the regulated and open market



Introduction of market based mechanisms for operation of the balancing energy market

FUTURE DEVELOPMENTS -2



Elaboration of transparency mechanism for calculation of the balancing energy prices taking into consideration:

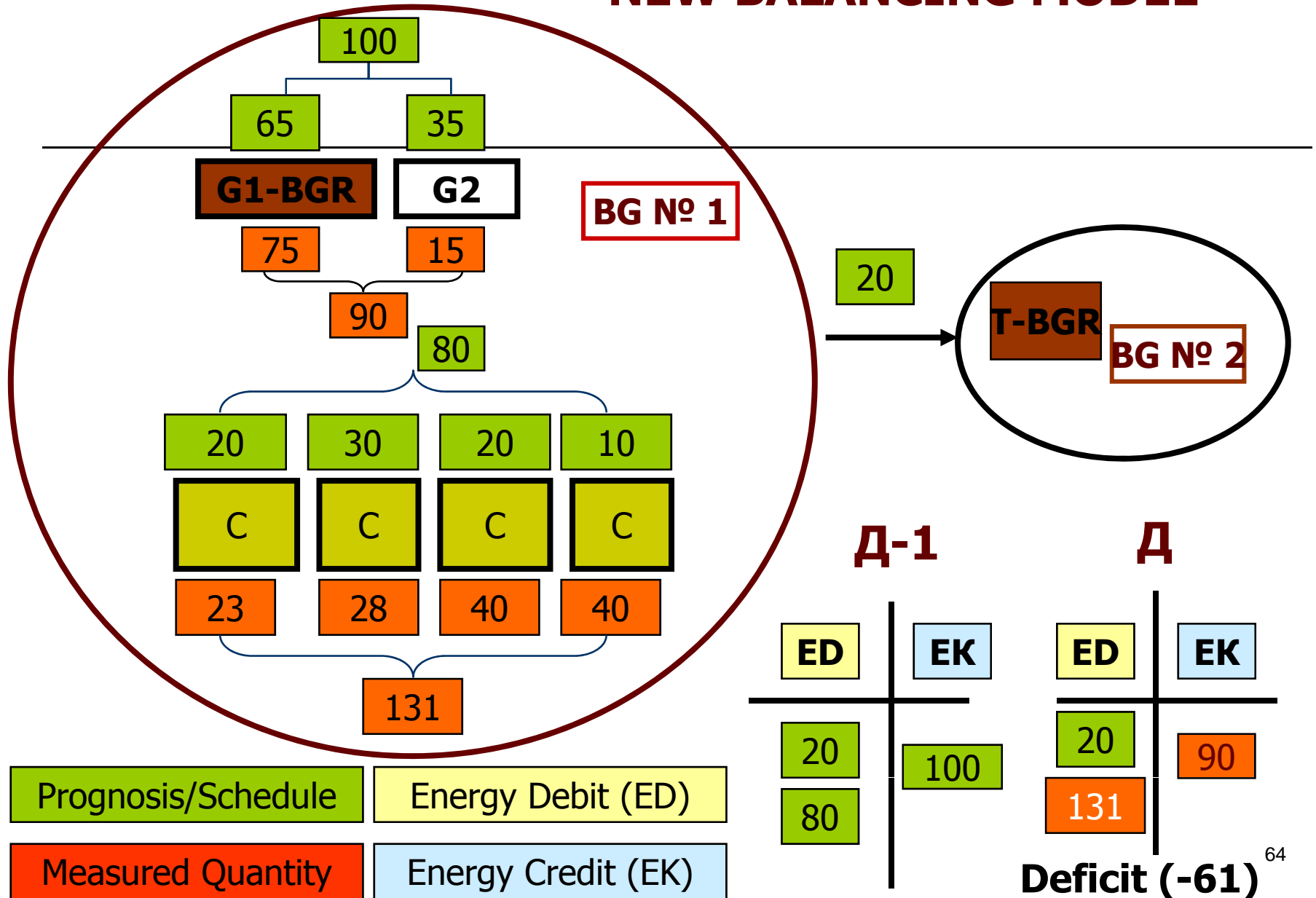
- ❖ **Expenses of the BSO for payment of the energy provided as result of participation in the primary and secondary regulation**
- ❖ **Expenses of the BSO for payment of the energy provided under activated Offers and Bids**
- ❖ **Expenses of the BSO for payment of capacity and energy from activated 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

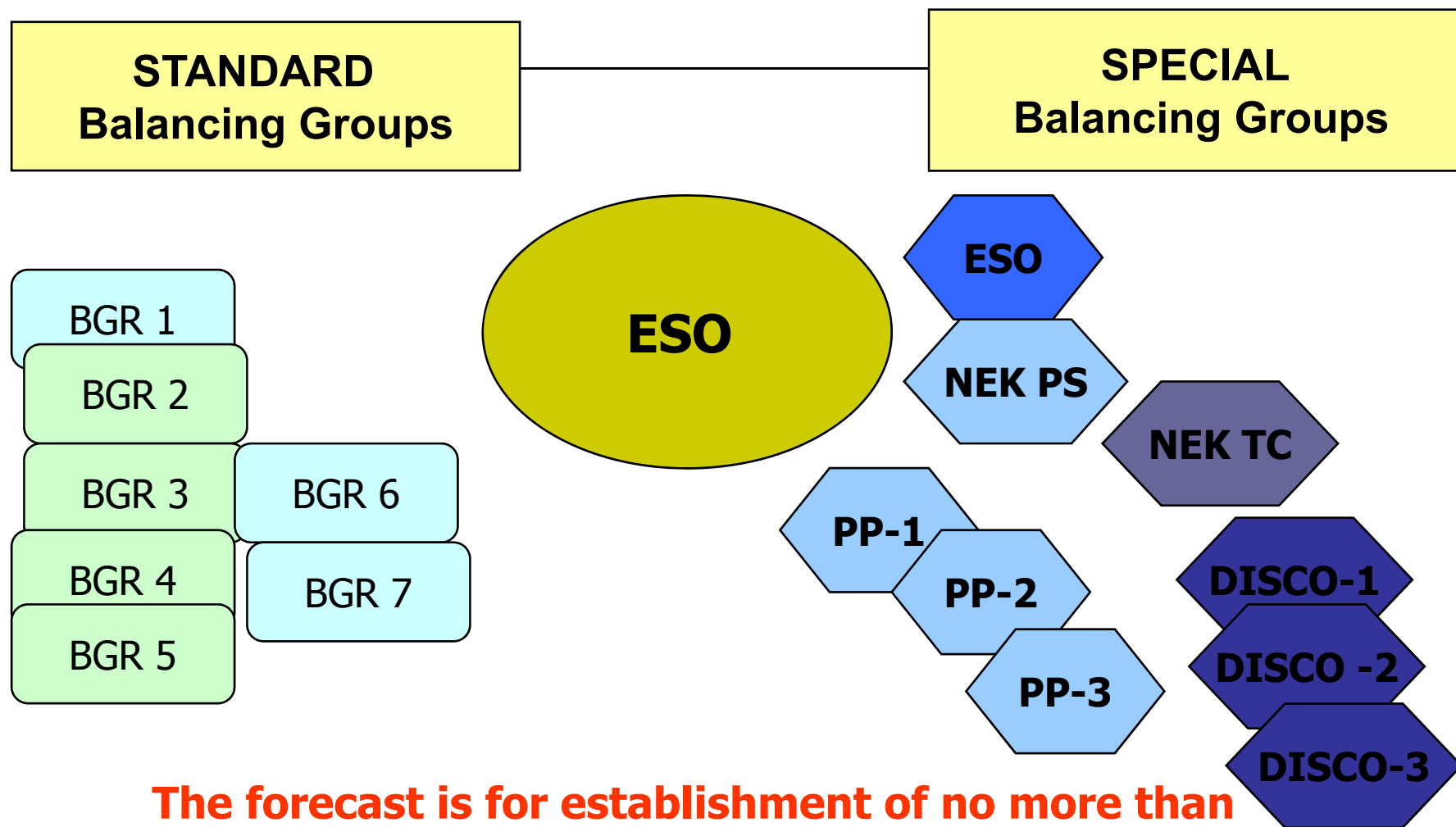
- ❖ **All Generators have to contract electricity for the market on an hour by hour basis within the working range of the units**
- ❖ **Participation of the Generators in the Primary, Secondary and Tertiary Regulation (ancillary service market) has to be remunerated separately by the BSO**
- ❖ **Expenses 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



RELATIONS OF ESO ACCORDING TO THE NEW POWER MARKET MODEL



The forecast is for establishment of no more than 15-20 Balancing groups



BALANCING GROUP RESPONSIBLE PARTIES

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**

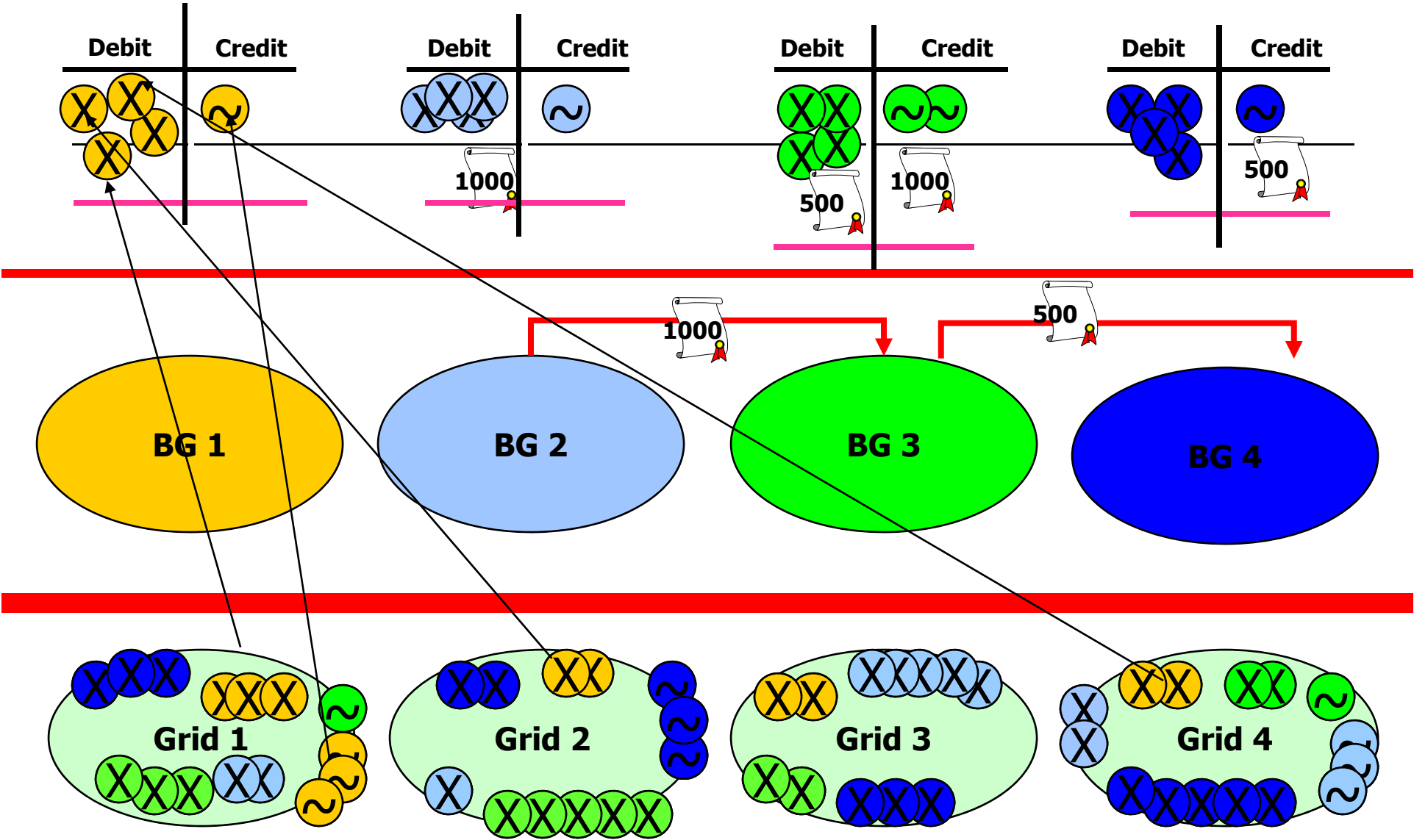
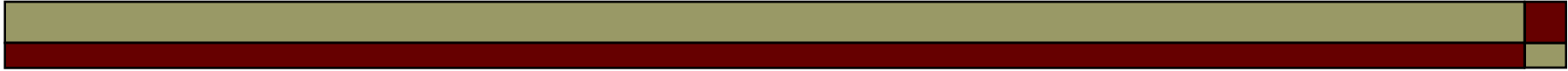


Organization and settlement of balancing groups (BG) -2

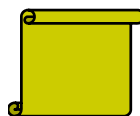
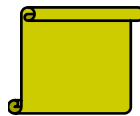
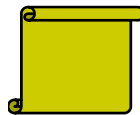
Each balancing group has an energy account with the ESO

Credit of account

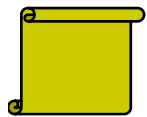
- ❖ **Generated energy (measured) of all members and their metering points belonging to the BG**
- ❖ **Energy volumes of all contracts for purchasing energy from other BG and/or import contracts**
- ❖ **Balancing energy from activated bids, including energy provided as result of primary and secondary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



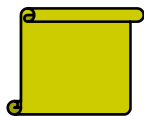
Advantages of the new model -1

-  **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 participants⁷⁰**

Advantages of the new model -2

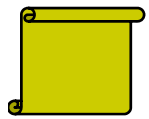


Market means clear and strong Rules for determination which participants have to be penalized and how much and which participants have to be remunerated and how much

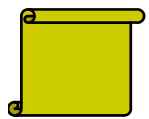


Market means the ESO to maintain contacts not with all market participants, but only with BG Coordinators (BGRP) which relations are much more effective and operational

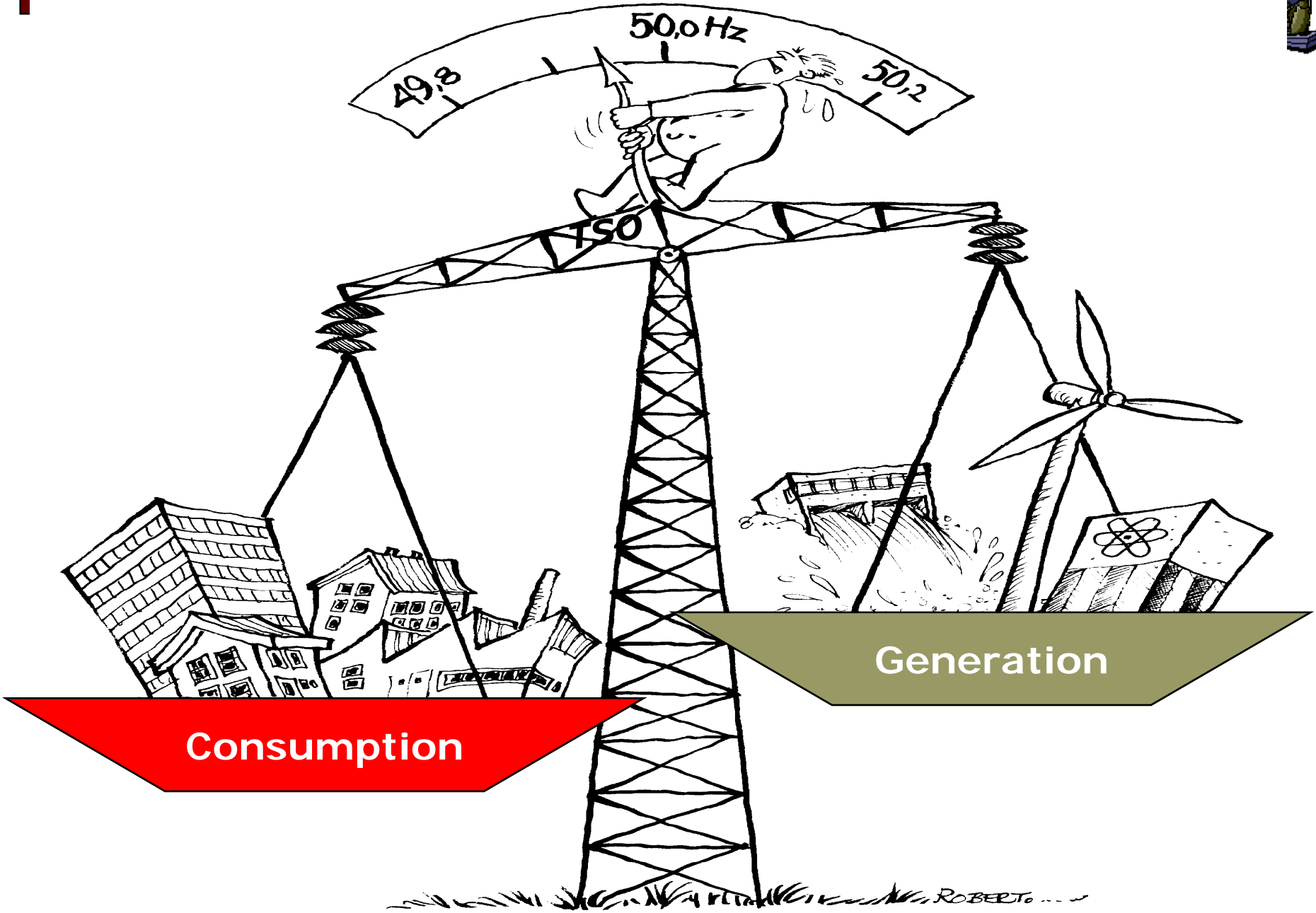
Advantages of the new model -3



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 !**

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