

# **Energy Resources and Security of Supply in Serbia**

## ***Energy Balances and Infrastructure Development***

*Ljiljana Hadžibabić*  
*Head of the Technical Department*

**Energy Regulatory Partnership Program**  
**The Energy Regulatory Agency of the Republic of Serbia &  
The Pennsylvania Public Utility Commission**

**Belgrade, October 29<sup>th</sup>, 2007**

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## Energy Resources and Security of Supply in Serbia: Energy Balances and Infrastructure Development

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Progress and challenges
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Progress and challenges
3. **Distribution** infrastructure expansion:  
Progress and challenges
  - Site profiles (installed capacity, fuel source)
  - Approval process (licenses and permits)
  - Integration into existing grid
  - Regulatory, policy, legal, technical considerations

# Serbia

## geographic position



# Serbia



**Land Area** 88,173 sq km  
(34,449 sq miles)

**Population** 10.2 Million

**The main religion -** Christian  
Orthodox

**Estimated GDP for 2007 – around**  
**US\$7, 200 per capita (IMF).**

**Capital – Belgrade,**

- Latitude 44° 00'N
- Longitude 21° 00'E
- Population 1.6 Million



# Energy Resources

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Serbia is not particularly rich in energy resources.  
The yearly needs of primary energy is app 15 M t oe.

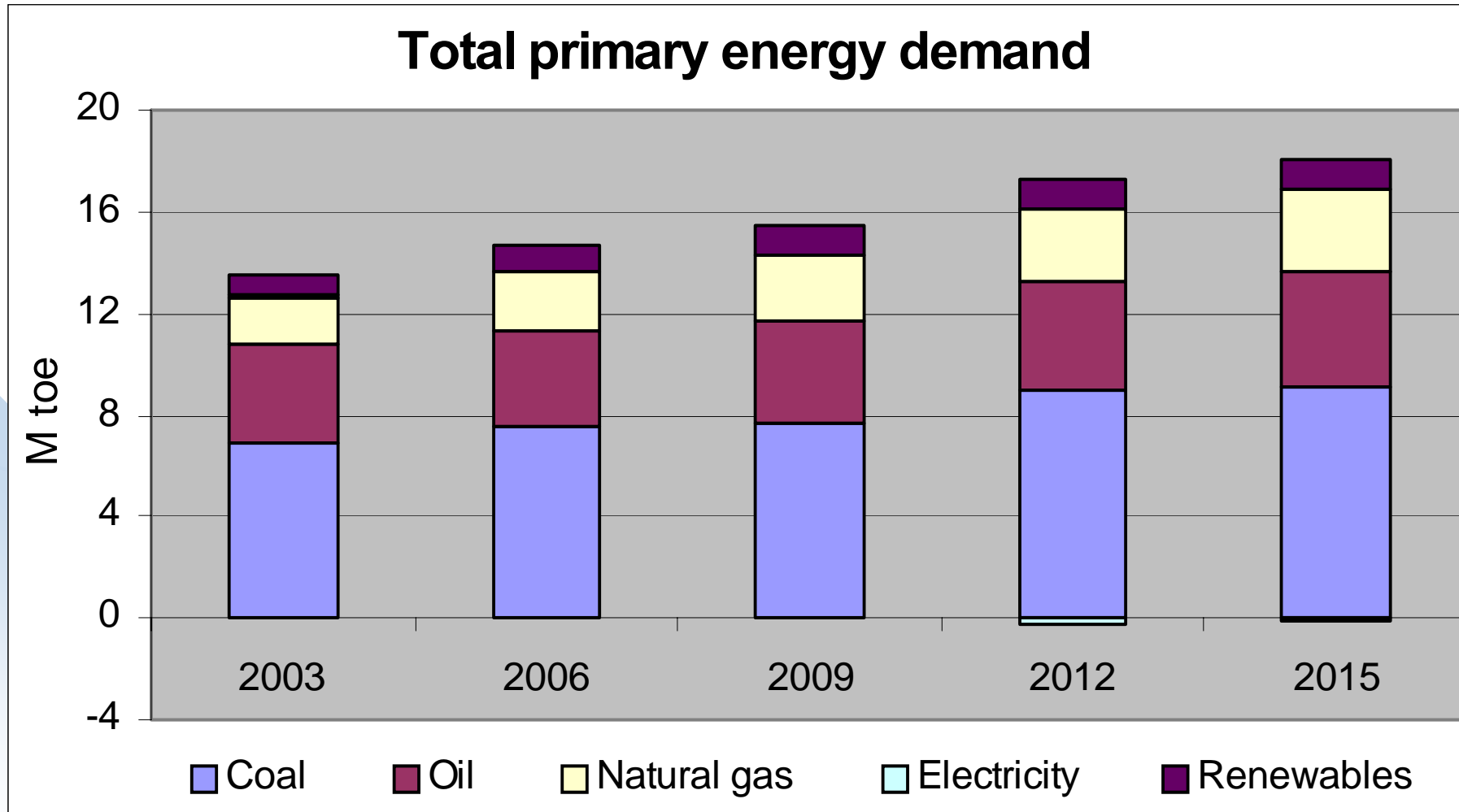
**Import: app 47%**

**Oil – 83%**

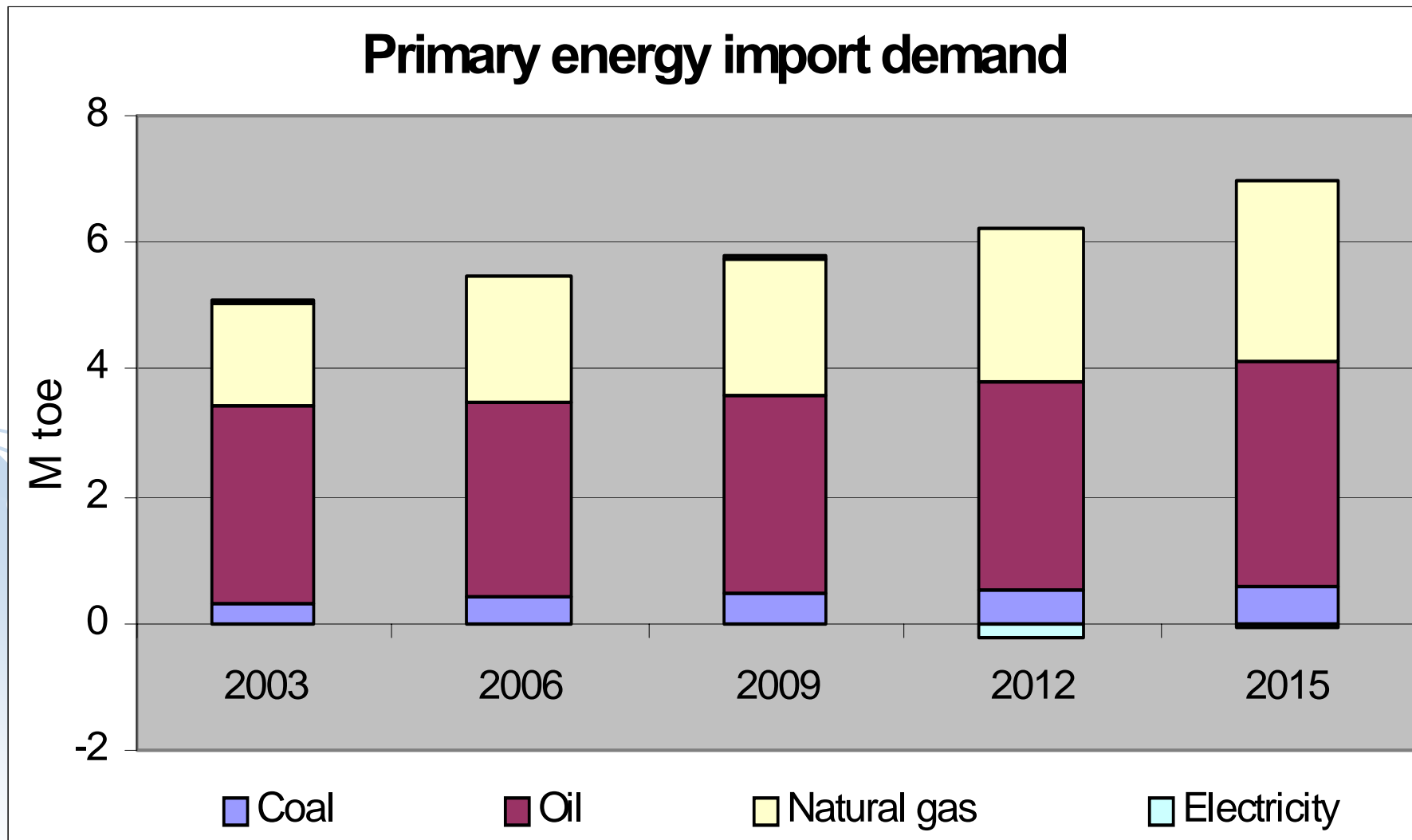
**Gas – 91%**

**Electricity – periodically (winter season)**

# Primary Energy Demand Forecast (1)



## Primary Energy Demand Forecast (2)



# POWER SECTOR

## - Basic Information -

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### Company:

**EPS<sup>1</sup>** - state-owned, vertical integrated Holding

[www.eps.co.yu](http://www.eps.co.yu)

- 5 generation companies
- 1 coal-production company
- Wholesaler
- 5 distribution companies  
with retail for tariff customers

**1 - EPS – Electric Power Industry of Serbia**




# Electricity Generation

## - Basic Data -

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**Generation facilities 8.355 MW** (1200 MW at KiM\*),

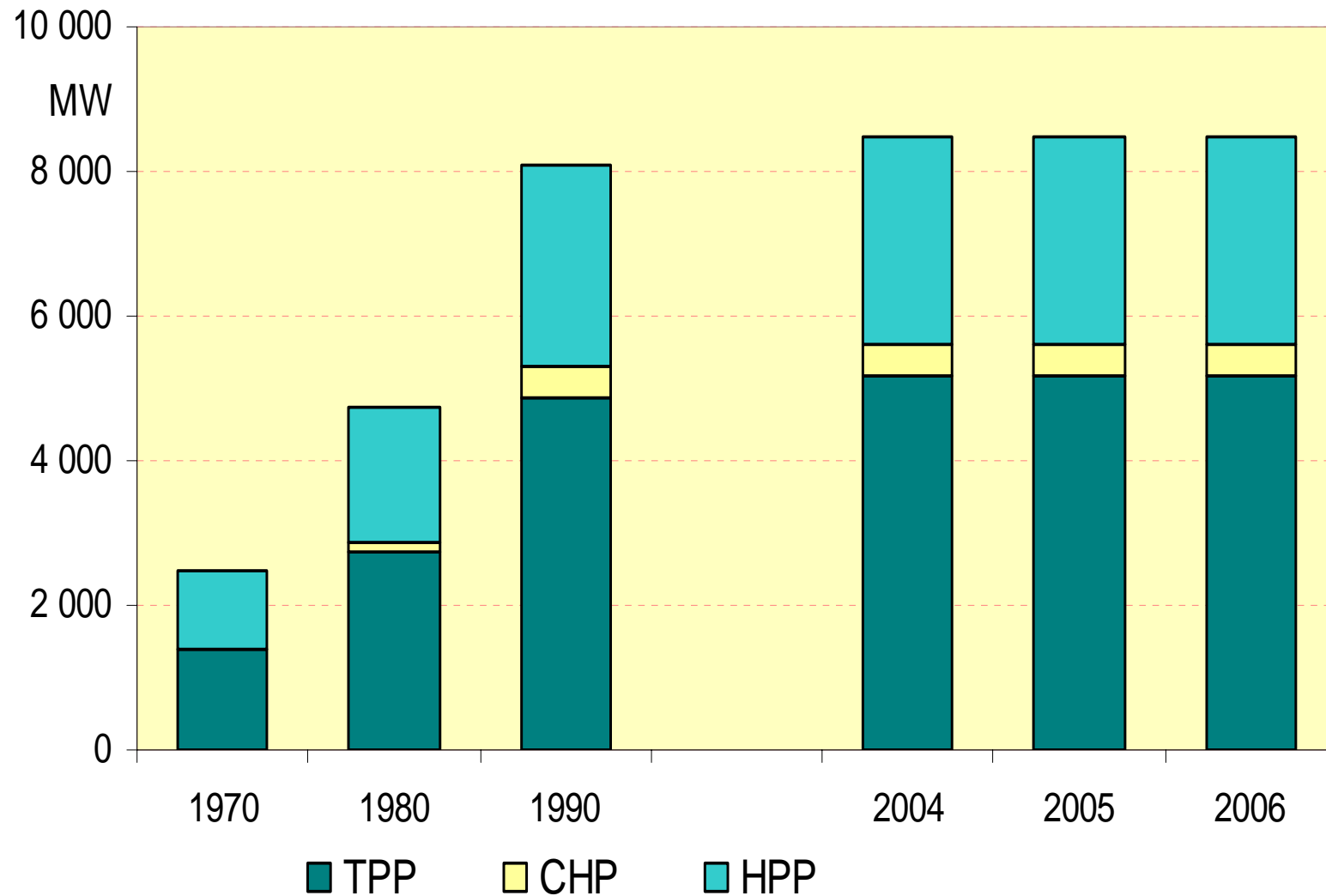
**2006:**



• <b>Generation</b>	<b>38.5 TWh</b>
• <b>Gross Consumption</b>	<b>37.1 TWh</b>
• <b>Import</b>	<b>0.9 TWh</b>
• <b>Export</b>	<b>2.1 TWh</b>
• <b>Transit</b>	<b>6.0 TWh</b>
• <b>Lignite Production</b>	<b>36,1 mill t</b>

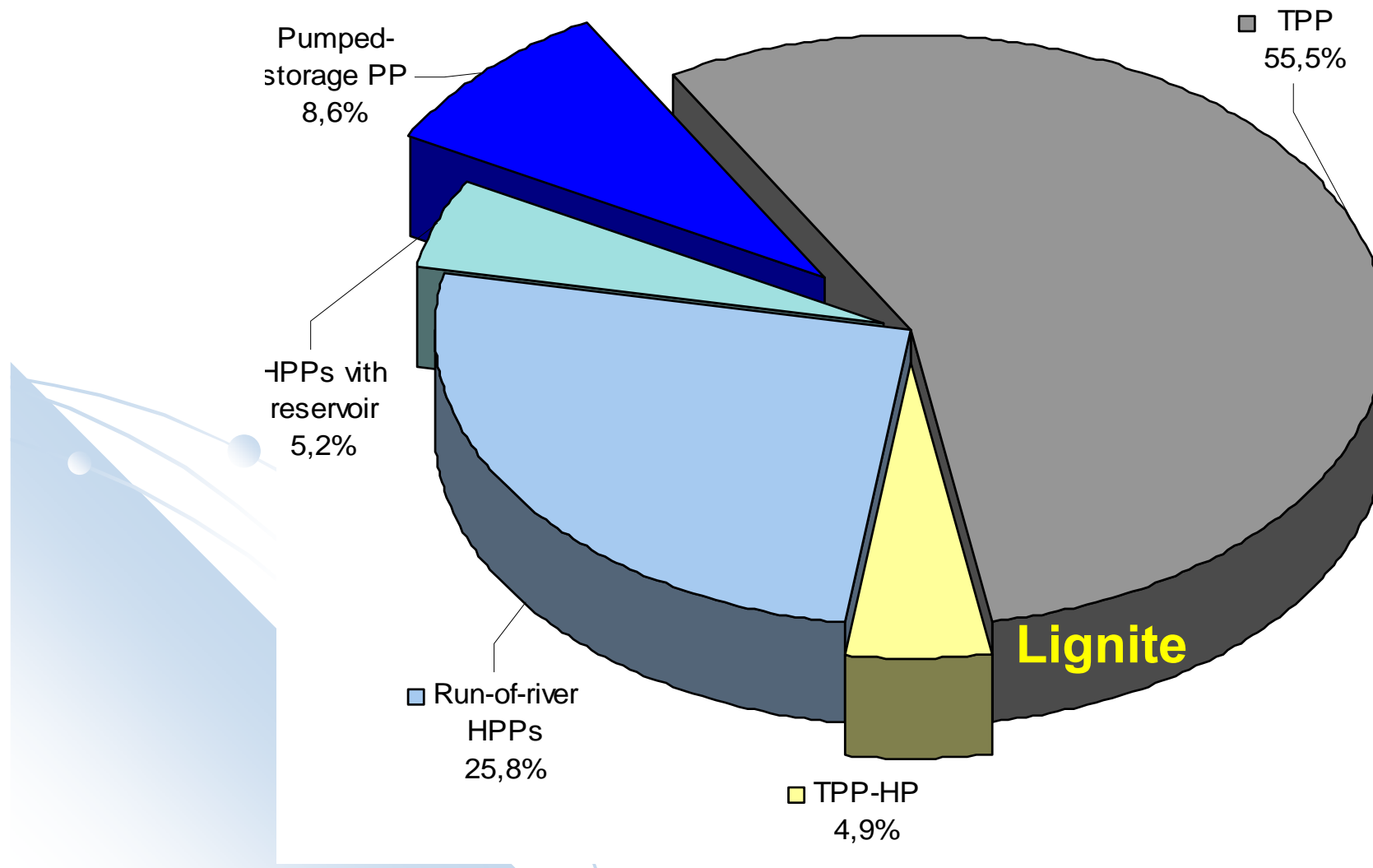
\* - KiM – Kosovo and Metohija, under UNMIK responsibility

# Generation infrastructure



# Structure of Power Generation (without KiM)

**7155 MW (+ 1200 MW at KiM)**



# New capacities preconditions for construction

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## Energy permits

- responsibility of the Ministry of mining and energy:
  - generation facilities of power  $> 1$  MW;
  - power transmission and distribution facilities with voltage  $> 35$  kV,
- permits issued in accordance with: Energy Strategy and Strategy Implementation Programme
- result of adequate analyses ➤ public tender
- concession

## Optimal integration into existing grid

The Technical Codes define all necessary analyses and technical criteria (Grid Code and Distribution Code).

# New capacities preconditions for operation

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## Licenses

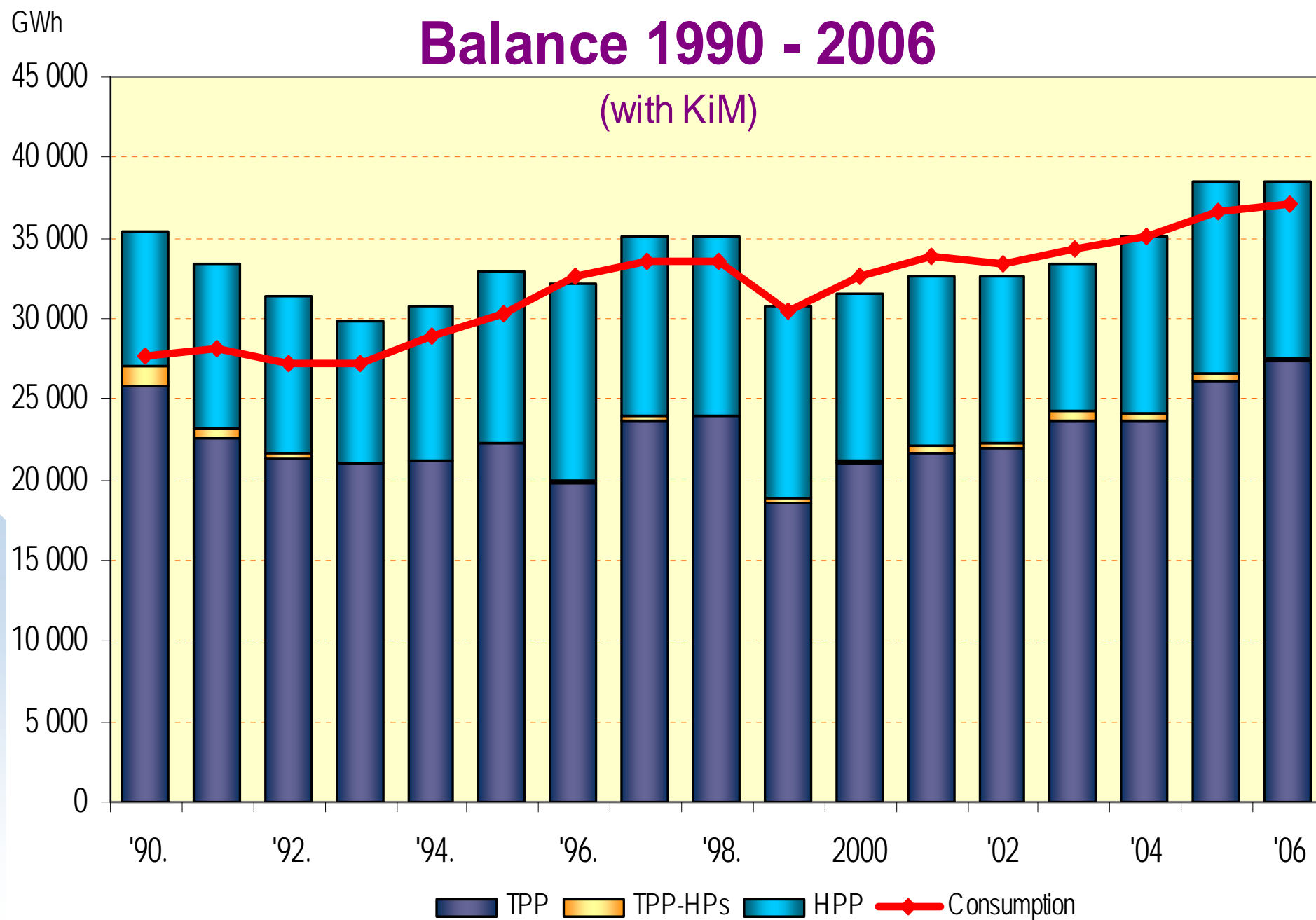
### – The Agency responsibilities:

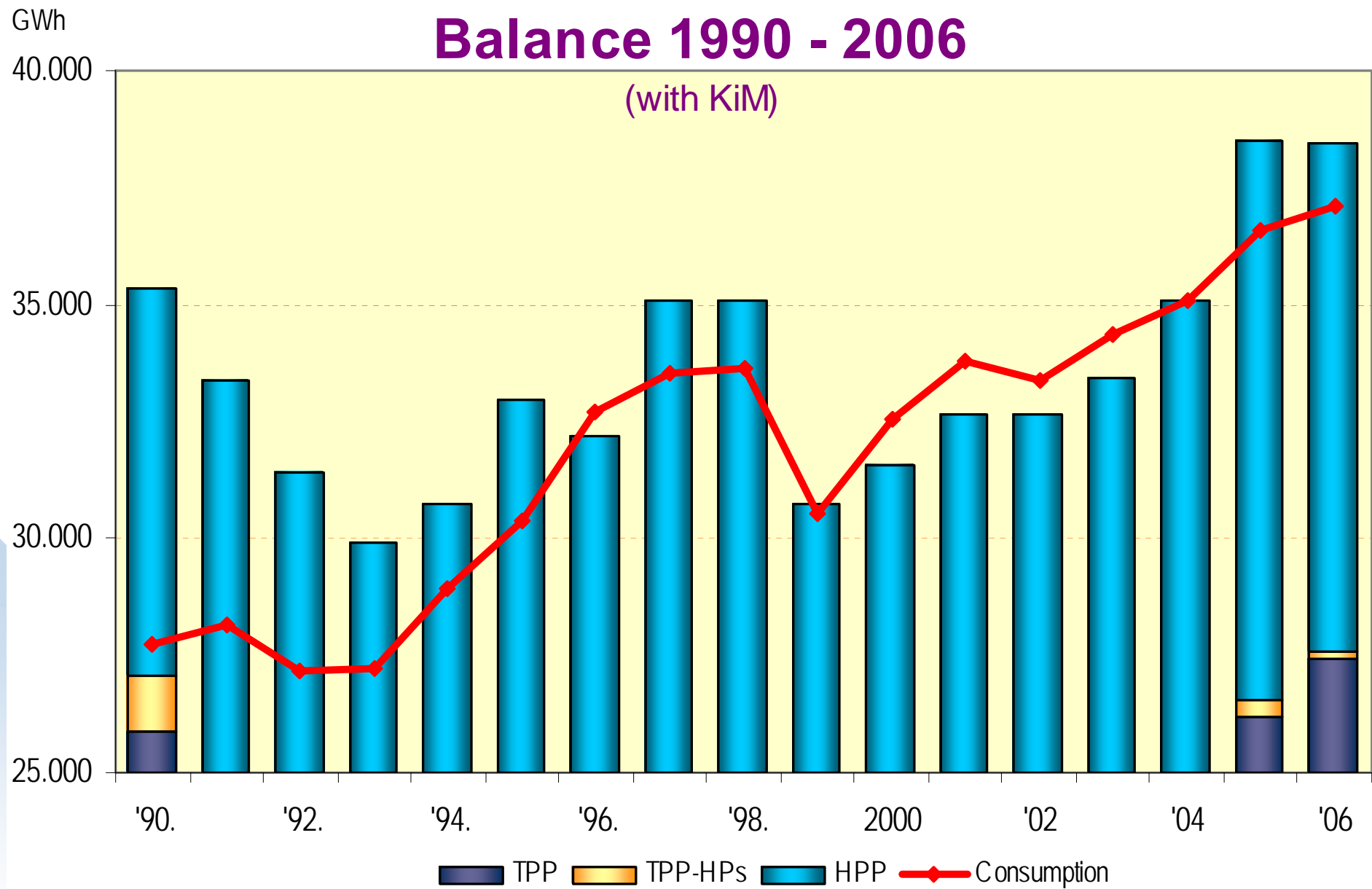
- issuing licenses in accordance with License Code
- revoking licenses
- keeping the licenses register,
- monitoring of compliance with license requirement

### – License Code - rules are defined by the Ministry.

# Balance 1990 - 2006

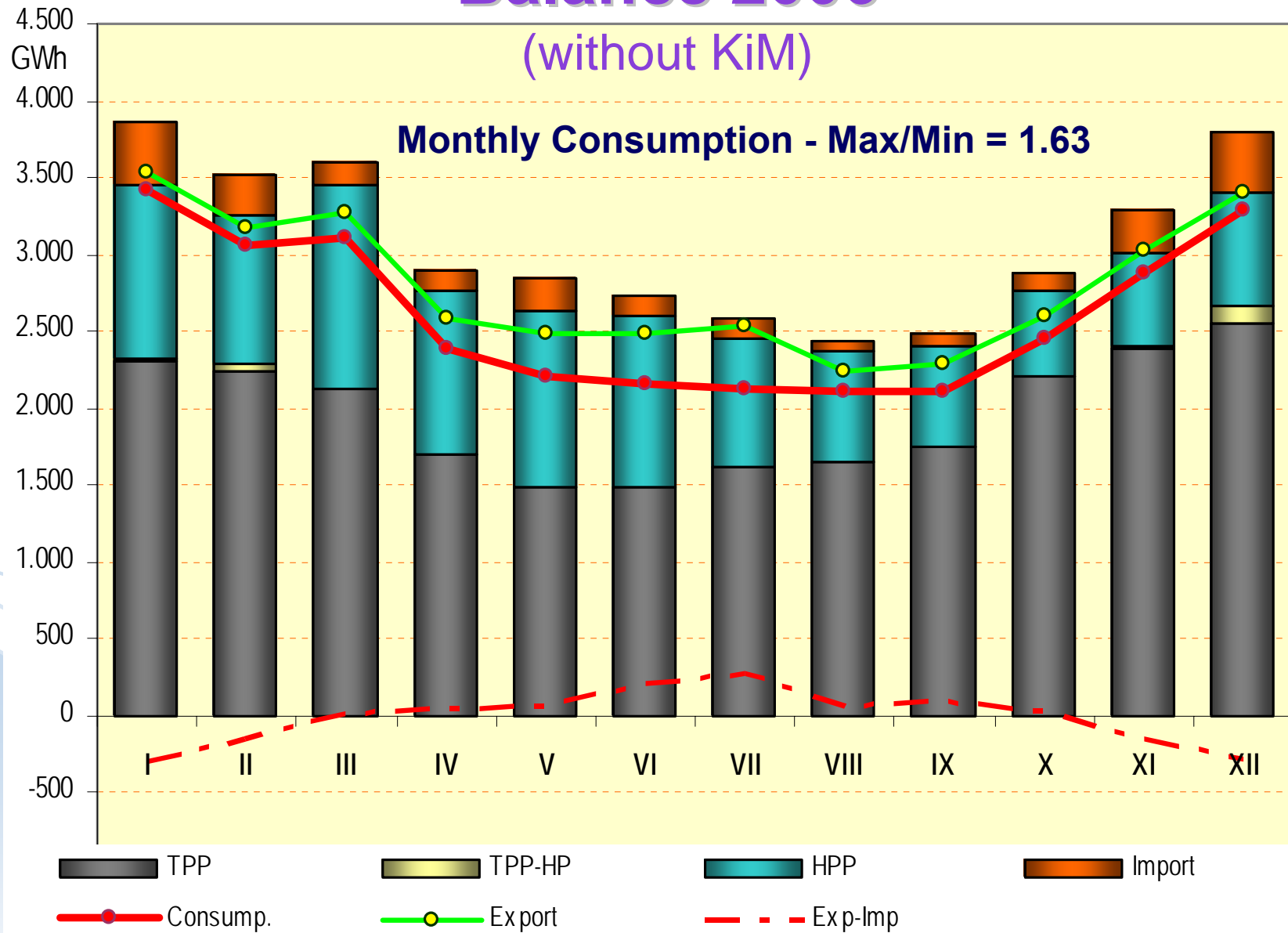
(with KiM)





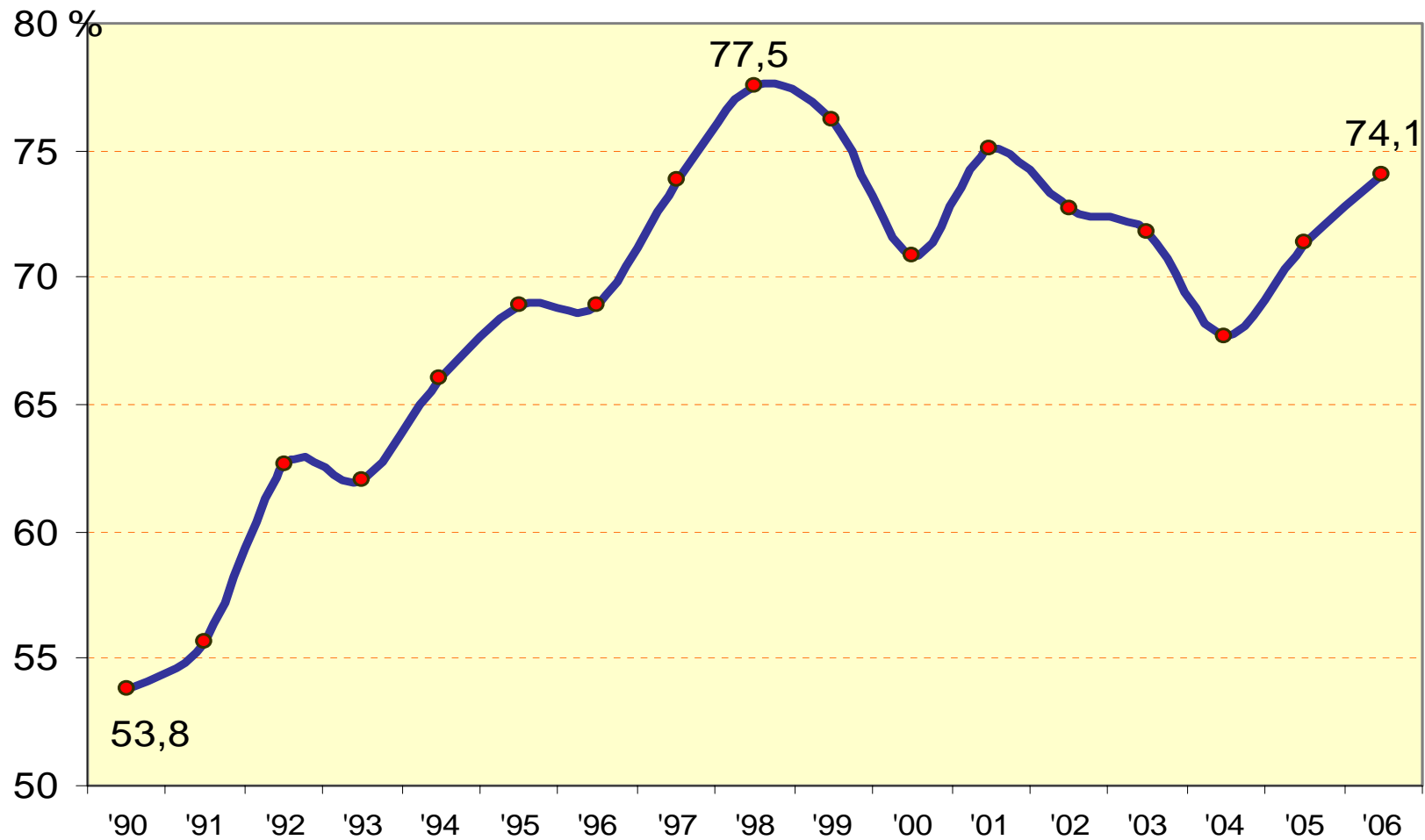
# Balance 2006

(without KiM)



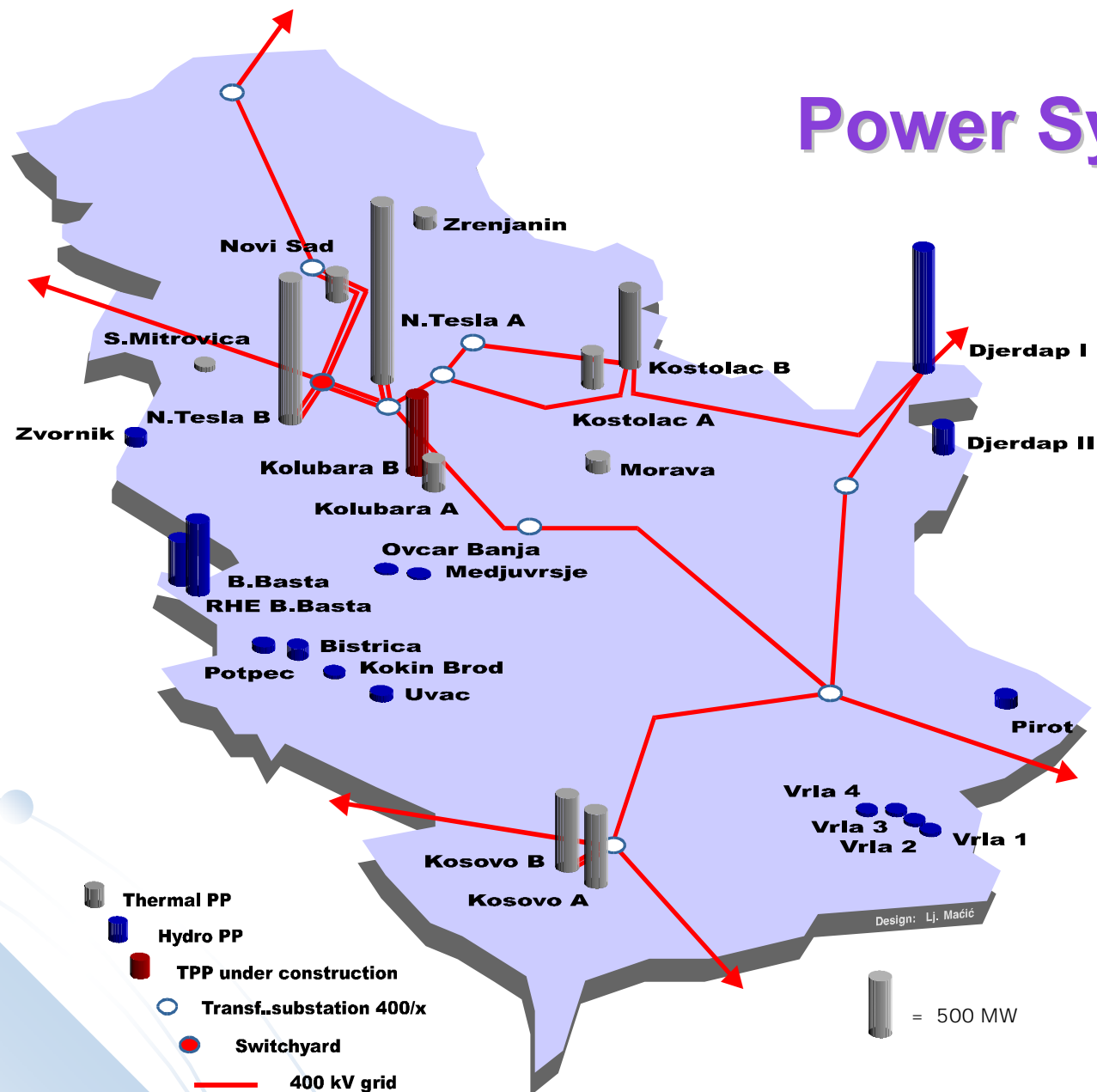


# Max Peak Load / Generation Capacity



# Power System

UCTE  
Oct 2004



# Serbia's Power System

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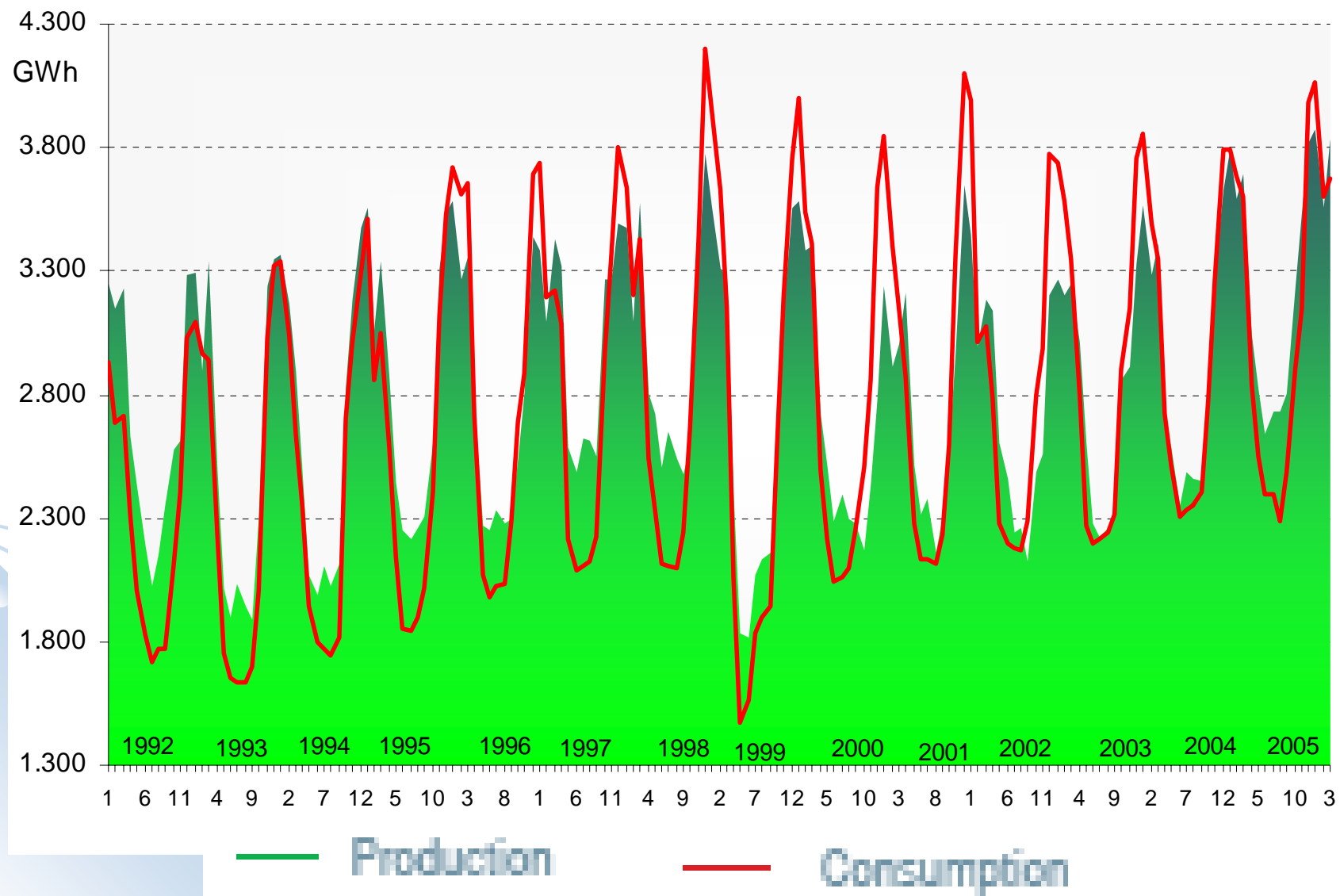
## Advantages

- ◆ Favourable position in the Region
- ◆ Significant share of HPPs (40%)

## Great Problems

- ◆ Big seasonal difference in consumption
- ◆ Delay with:
  - New generation capacity construction and
  - Revitalization and modernization of existing generation facilities

## THE RANGE OF THE MONTHLY PRODUCTION AND CONSUMPTION



Average age of

TPPs –  
28 years,

HPPs  
34 years,

The basic equipment  
in open-pit mines –  
25 years



# Problems in the period 1990 – 2000

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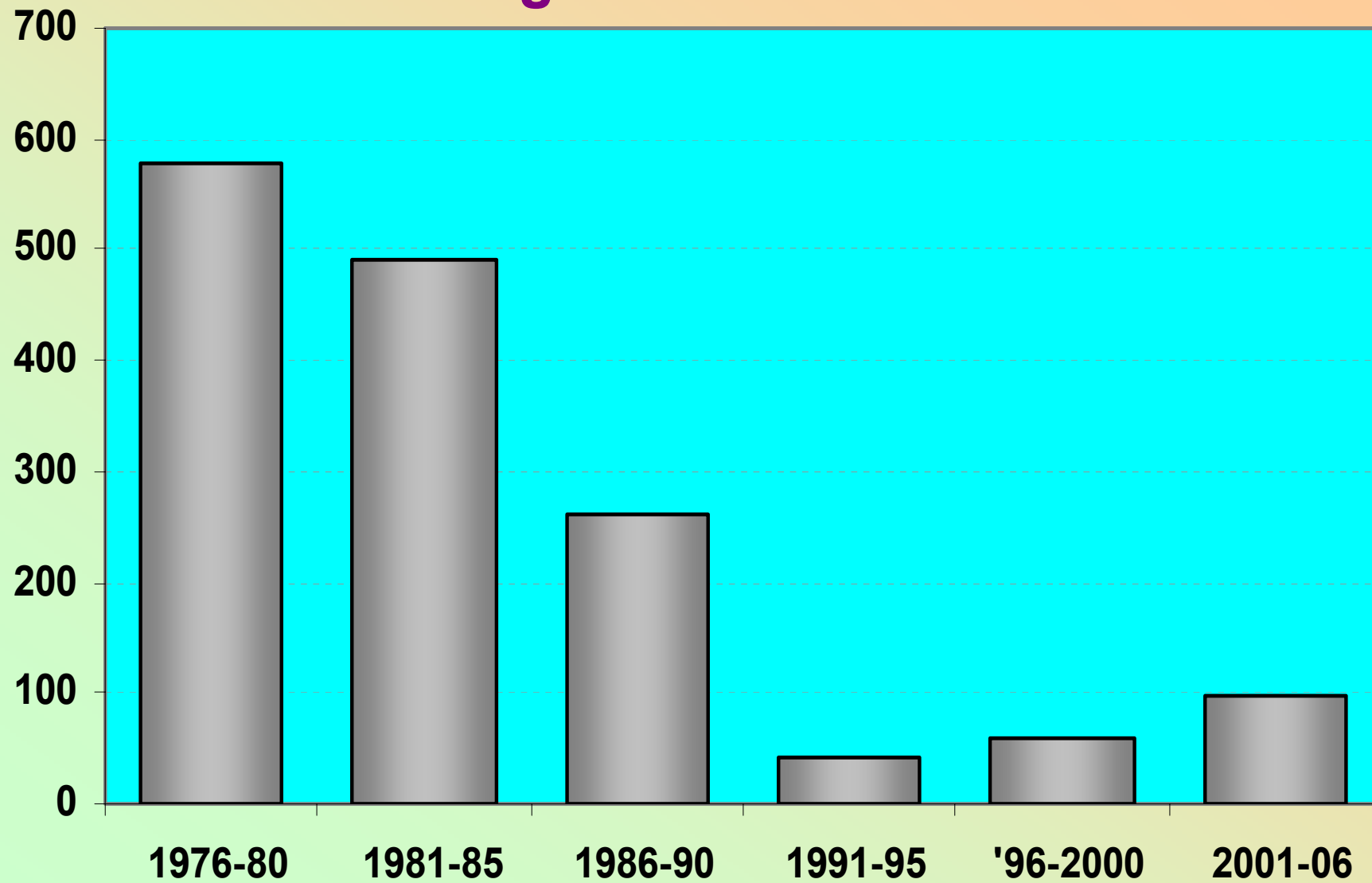
- **INTERNATIONAL SANCTIONS**
  - Lack of liquid fuels and natural gas
  - Lack of money for sustainable development
  - Lack of spare parts for maintenance
- **DETERIORATED AND OPSOLET EQUIPMENT**  
especially in TPP's and open-pit mines
- **LOW ELECTRICITY PRICE**
- **SIGNIFICANTLY INCREASED ELECTRICITY CONSUMPTION FOR HOUSEHOLD HEATING**
- **DAMAGE FROM NATO AIR STRIKES IN 1999**





mil.USD

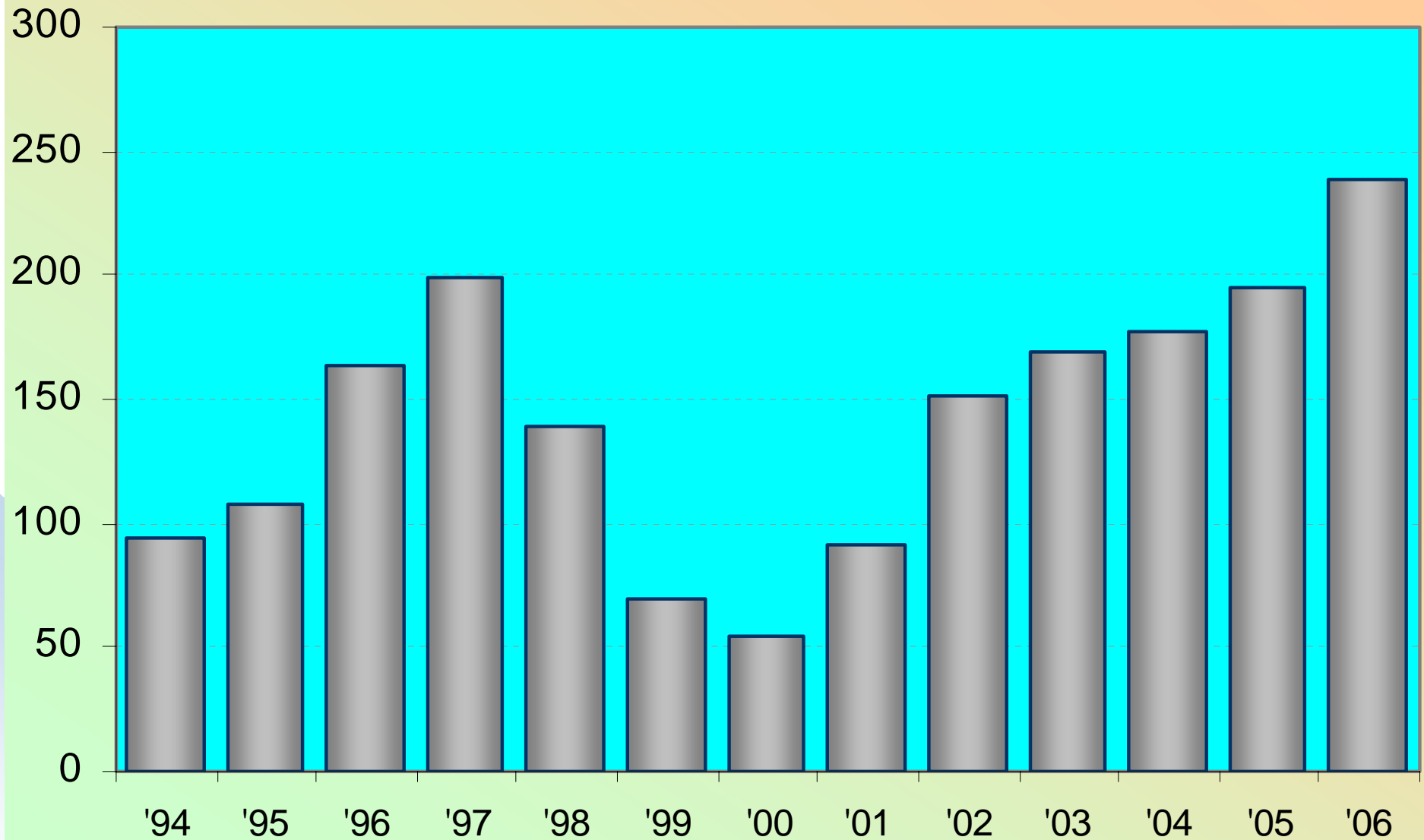
## Average Annual Investment





## Annual Maintenance

mil.USD



# Key Policy Goals

## after October 2000

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- Security of supply
- Electricity sector restructuring
- Market opening and development
- Incentives for private capital investments
- To reach the important role in the regional electricity market
- Internal efficiency increase
- Improved environmental protection
- Reduction of losses (technical and non-technical)

# International Community Assistance

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## After October 2000

450 mil € donations - mostly from EU through EAR

### Main areas of assistance:

- Electricity imports
- Fuel for heating
- Spare parts and equipment for PP's and open-pit mines
- Overhauls of TPP's
- District heating systems of Belgrade, Novi Sad and Niš
- Reforms, capacity building and technical assistance

# Key Achievements (1)

2000

Insufficient production  
Low efficiency of PP's  
Damaged transmission network

*during winter season 2000/01*  
**55 days of power cuts**  
despite International Community Assistance

*average final price for all consumers*  
**0.8 ¢\$/KWh**

**TPP's EFOR 34%**

2006 / 07

- Increased production of coal and electricity
- Repaired and renewed transmission network

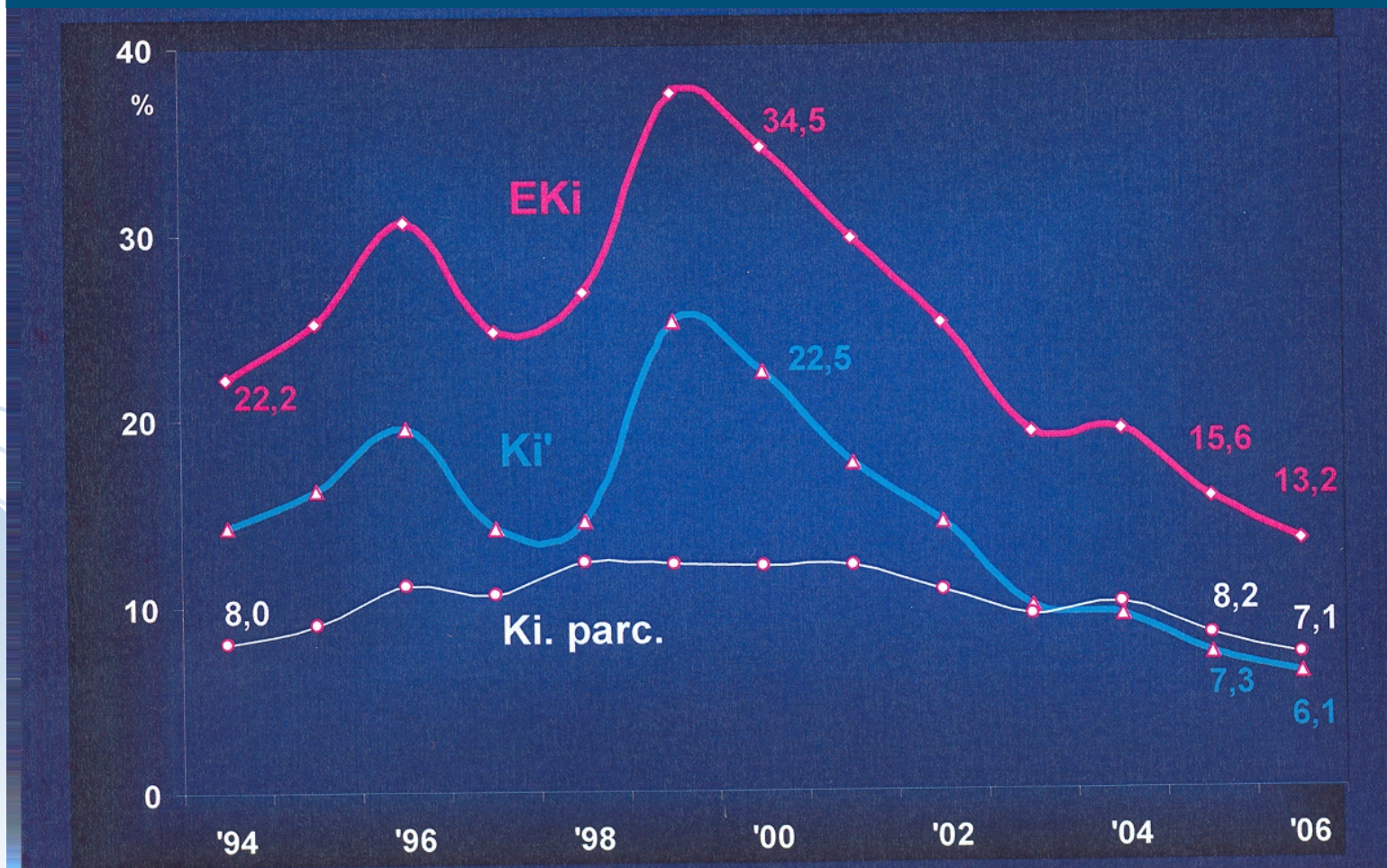
*Since winter season 2002/2003*  
**no power cuts**

*October 2007*  
**4.77 ¢e/KWh +**  
new tariff system implementation

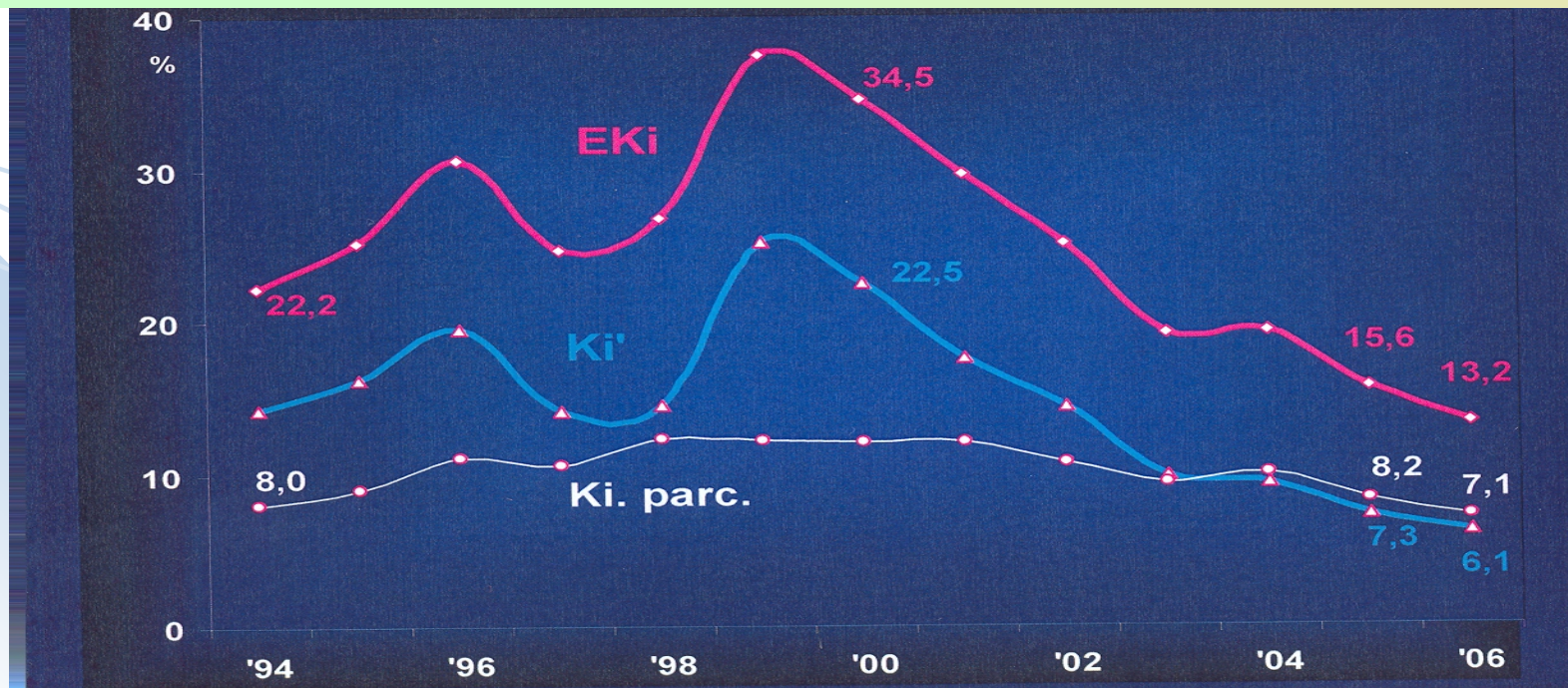
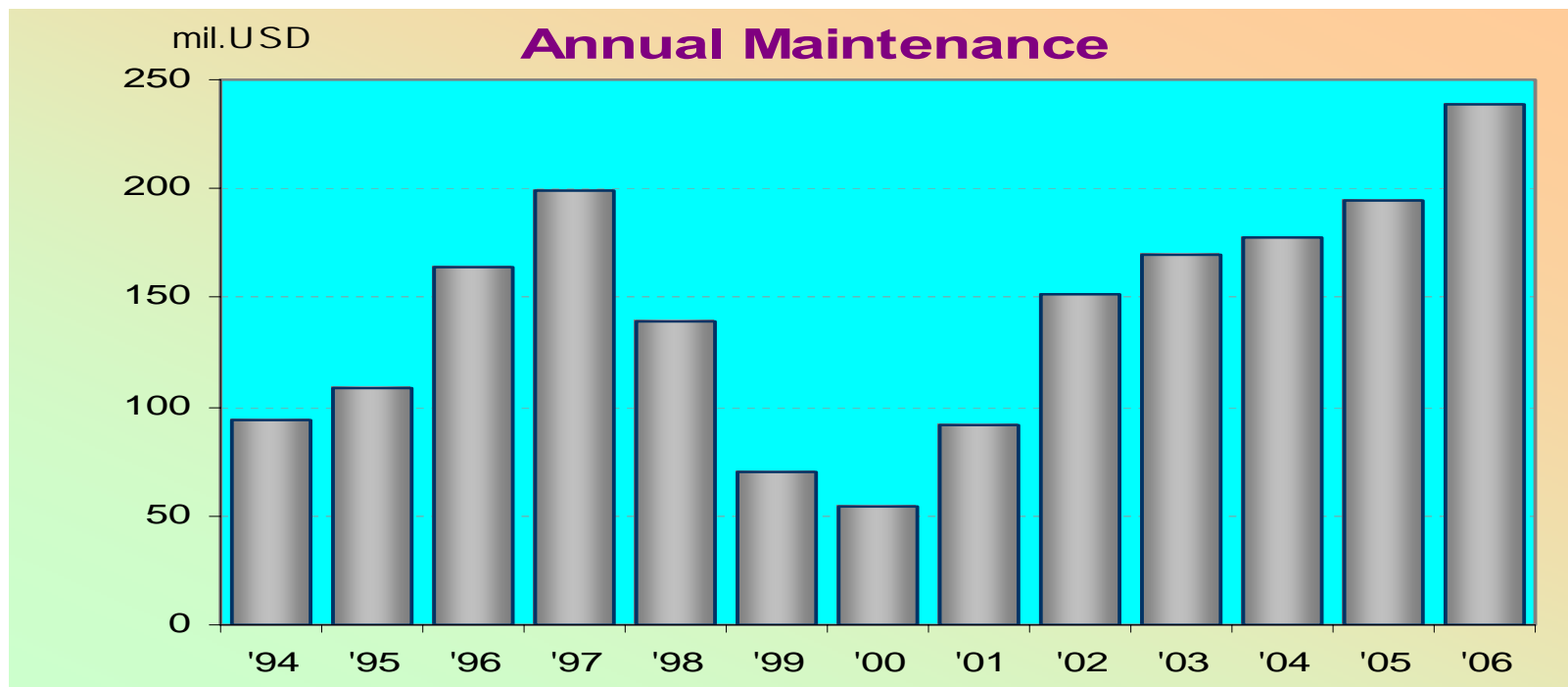
**TPP's EFOR 13,2%**

## Key Achievements (2)

### TPP's EFOR (without KiM)







# Development and Investments (1)

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REBIS: GIS Study, (WB, 2004)  
Data on South East Europe, 2005 - 2020:

SEE region will require

- 12,700 MW of new capacity
- 9,400 MW of rehabilitated capacity  
(to extend life time)

Serbia will require

- 640 MW of new capacity
- 2,800 MW of rehabilitated capacity  
(to extend life time - partly accomplished)

# Development and Investment (2)

## Demand Forecast :

Anticipated yearly increase (without KiM)

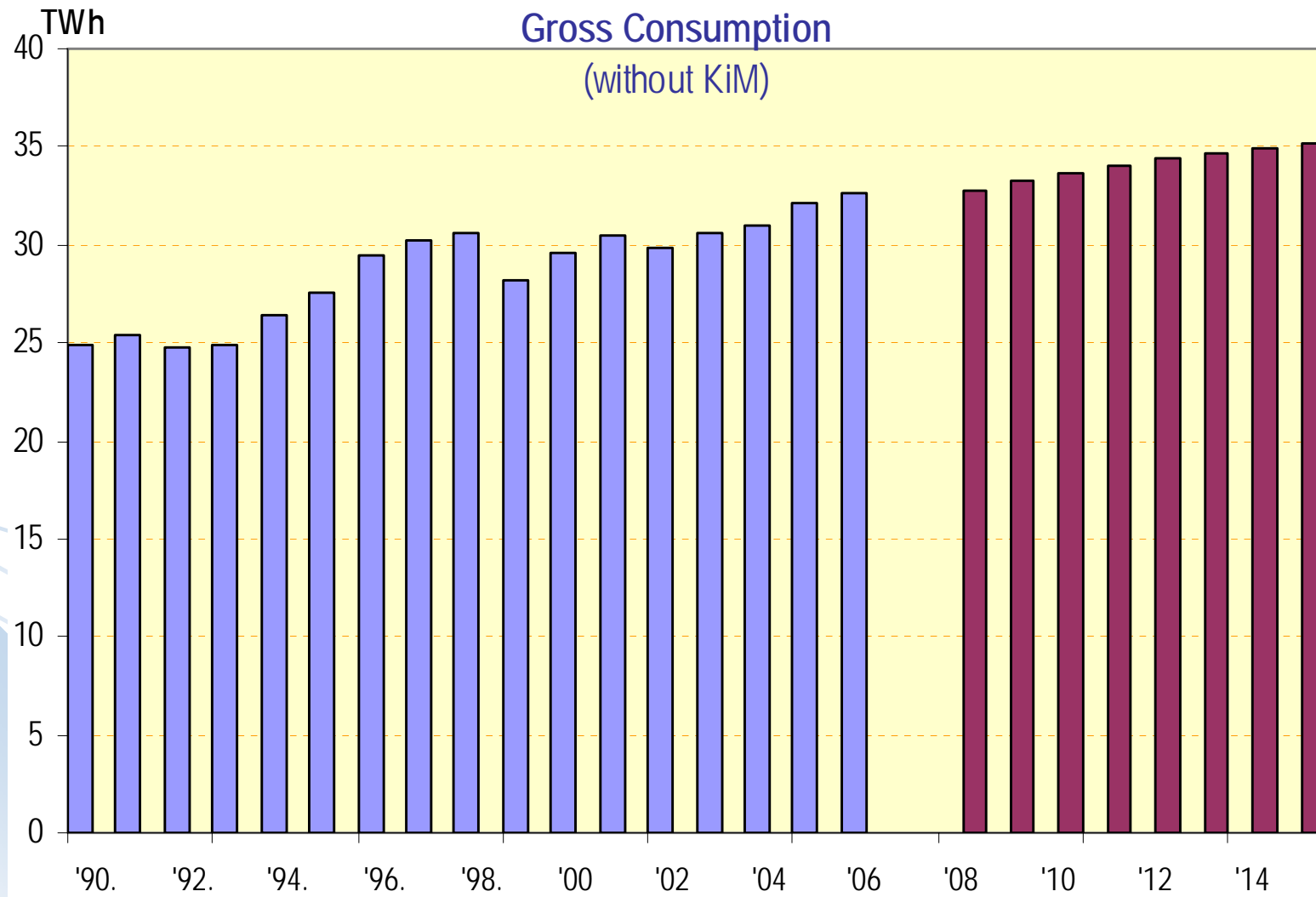
- REBIS-GIS Study (WB, '04): 1.6% -1.1%
- LCIP for Serbia (EAR, '05): 1%
- Serbian Energy Strategy ('05): 1.9%
- EPS ('07): 1.3 - 0.6%

## EPS's Assumptions:

- Economic electricity price
- Development of district heating systems
- Development of gas sector
- Effects of rationalisation



# Demand forecast by EPS



# Development and Investment (3)

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- Rehabilitation and modernization of existing facilities
- Construction of new capacities

## Domestic resources

- Lignite
- Hydro potential
- Renewable sources

## Imported resources

- Natural Gas

# Development and Investment (4)

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Rehabilitation and modernization  
of existing facilities

**The most important rehabilitation projects:**

- HPP Đerdap, 6\*176 MW
- HPP Bajina Bašta, 4\*91 MW



# Development and Investment (5)

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## Lignite - New Capacity

### Priority projects:

I. **TPP Kolubara B**

700 MW (2x350 MW) lignite fired power plant

App. EUR 750 million

II. **TPP Nikola Tesla B3 (TENT B3)**

700 MW lignite fired supercritical power plant

App. EUR 900 million

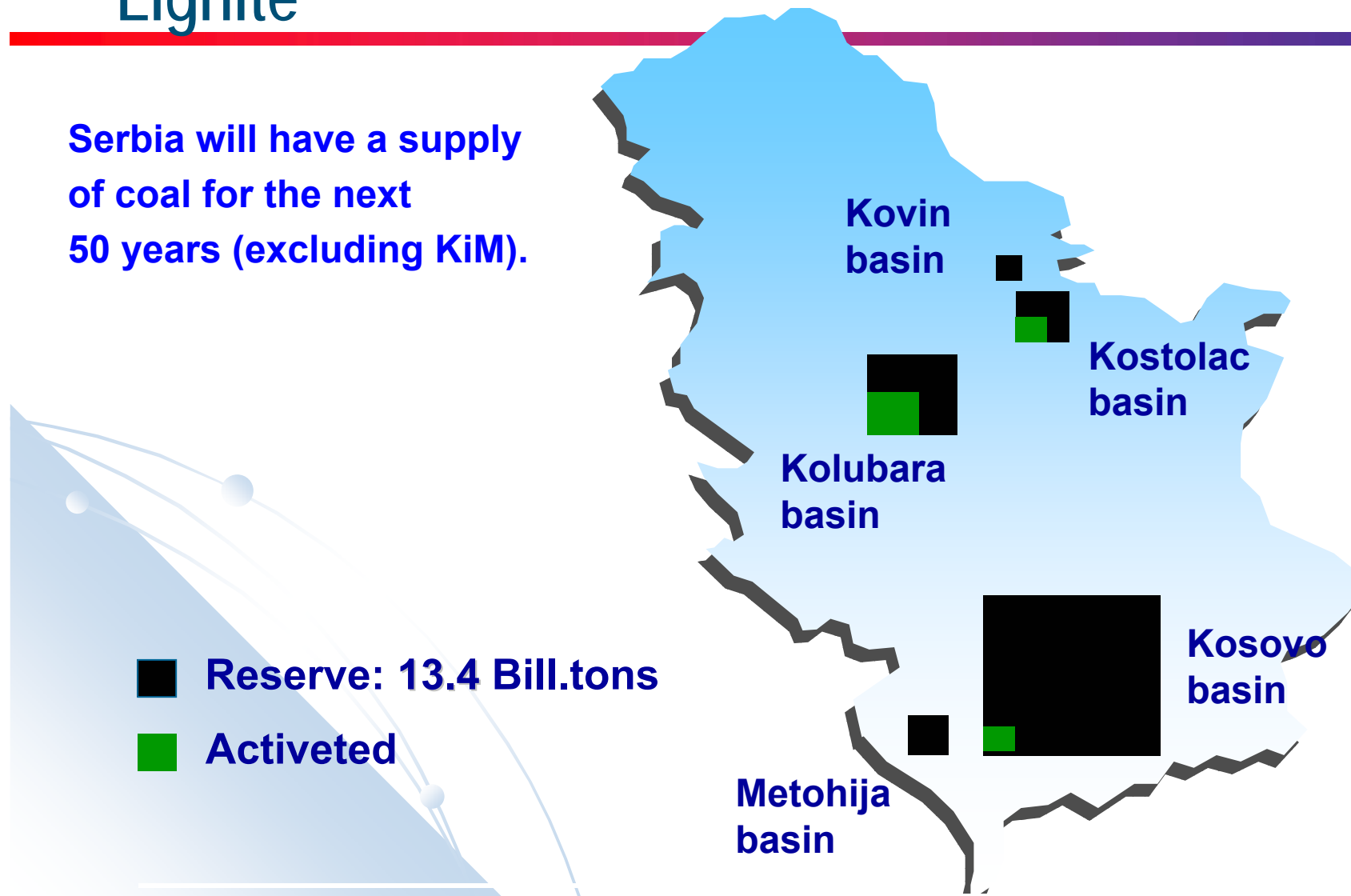
**with adequate capacity in Open Pit Mines**

# Development and Investment (6)

## Energy Resources

### Lignite

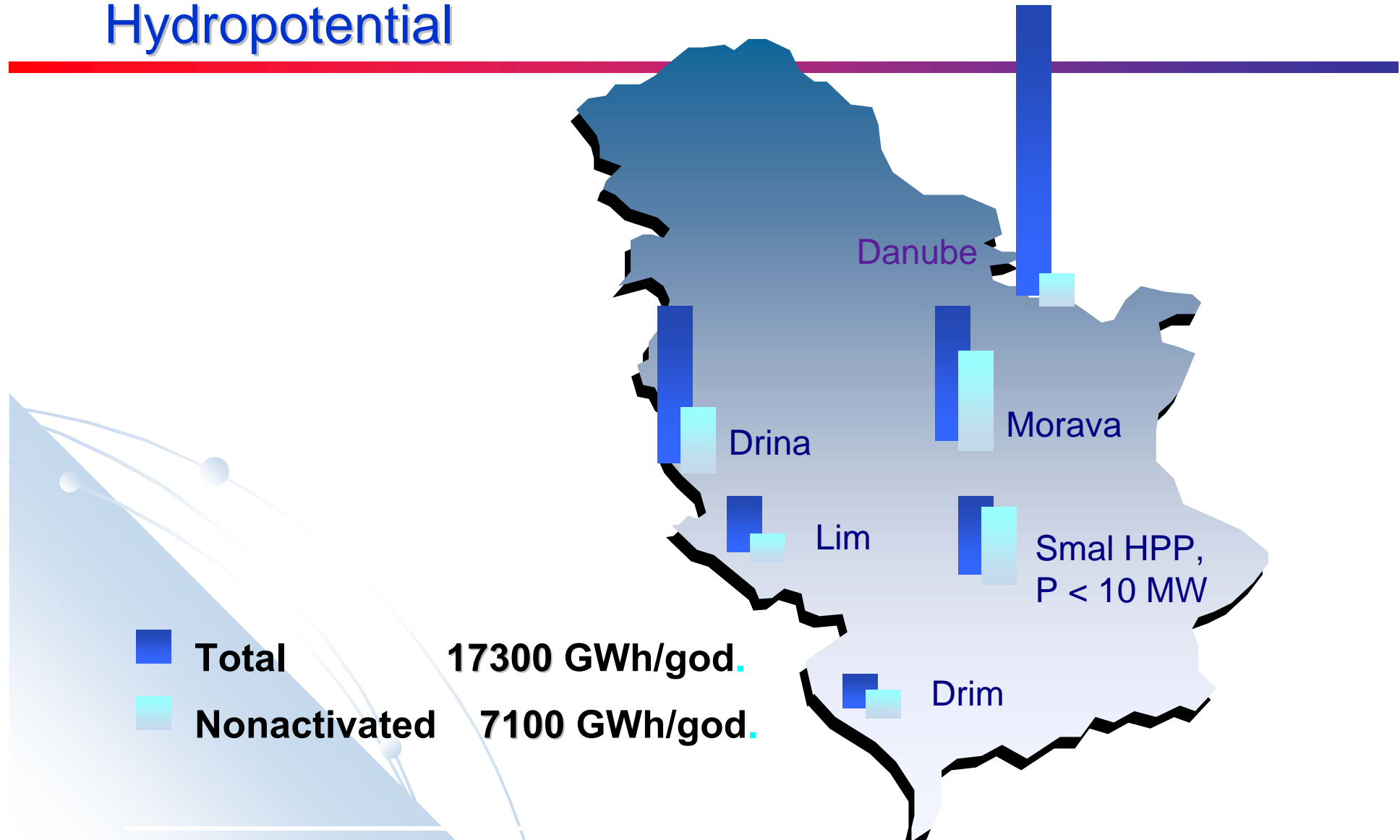
Serbia will have a supply of coal for the next 50 years (excluding KiM).



# Development and Investment (7)

## Energy Resources

### Hydropotential





# Development and Investment (8)

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## Renewable sources - Potential Assessment

- **Small Hydro PP**

CADASTRE of Small PP's ('87)

850 Sites

450 MW

1,500 GWh/year

- **Biomass**

- **Wind power plants - farms**

- **Waste incineration**

- **.....**



# Development and Investment (9)

## Natural gas

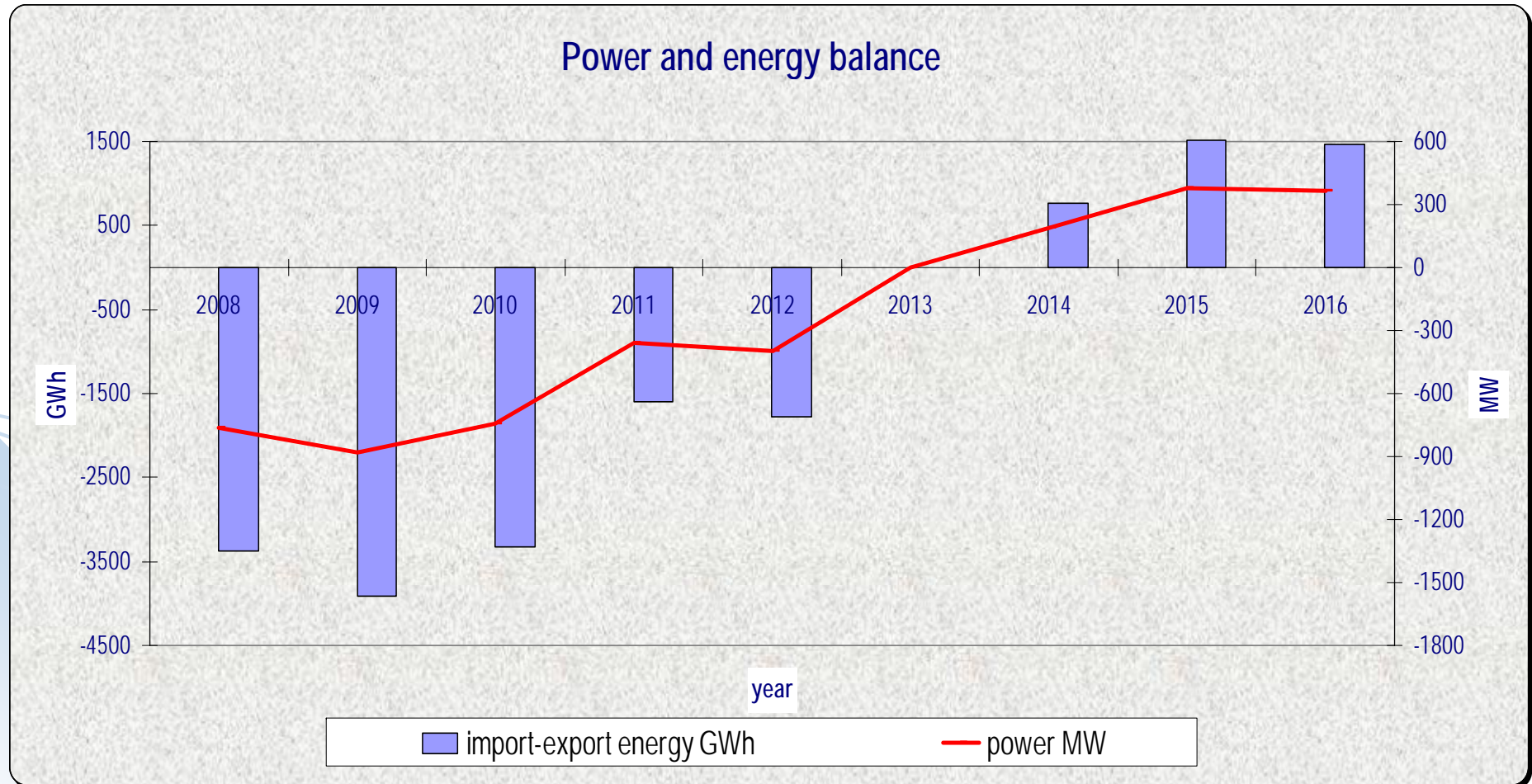
### **Reconstruction - Upgrading CHPP Novi Sad (208 MW)**

Optimization of existing plant  
and new unit – up to 450 MW  
gas-fired combined heat and power plant  
with combined cycle gas turbine.

Approximately EUR 120 – 160 million

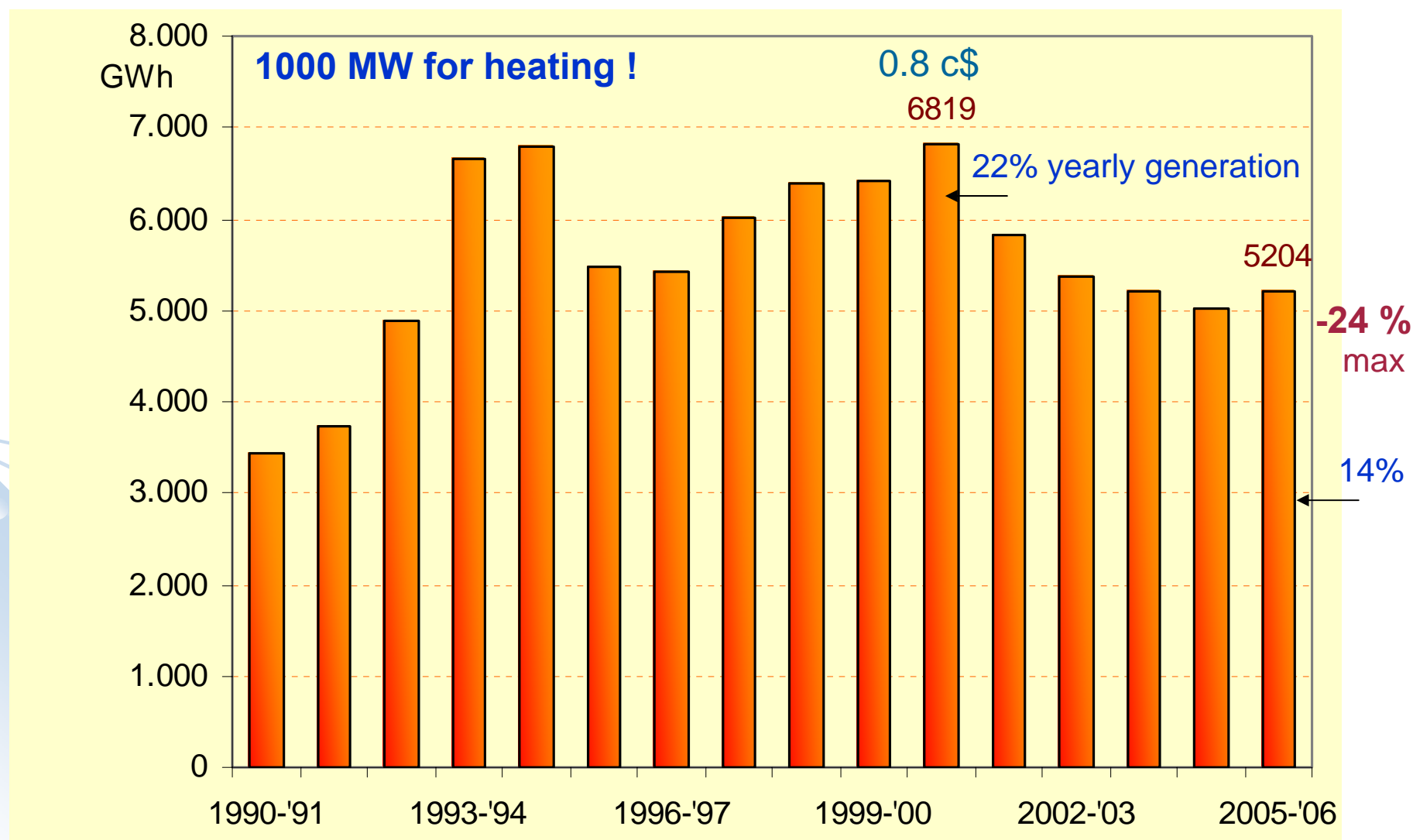


# New generation capacities securing energy balance after 2013



# Electricity used for heating

during winter seasons 1990/'91 - 2005/'06



# Improvement of Energy Efficiency

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## *Serbian Energy Efficiency Agency*

<http://www.seea.sr.gov.yu/English>

- Constituted in 2002
- Supported by EU (EAR) grant from CARDS programm, €3.8 mill

### **Energy Efficiency programs primarily for:**

- 
- Municipal Sector
  - Industry
  - Buildings stock
  - Transport
  - RES
  - CHP

# Environmental Protection (1)

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Plan for period 2007 – 2015  
Environmental measures on existing TPPs  
in accordance with the requirements of recent legal regulations

18 TPP Units: 2x600 MW, 6x300 MW, 3x200 MW, ...

Coal with low sulfur content:

- |                     |       |
|---------------------|-------|
| a) Kolubara lignite | 0.45% |
| b) Kostolac lignite | 1.30% |

No measures taken for sulfur and nitrogen oxide reduction

# Environmental Protection (2)

## Anticipated effects of planned air protection measures

	T O T A L t / a	
	Without modernisation	After modernisation
Dust	66.900	5.850
SO <sub>2</sub>	360.440	40.720
NO <sub>x</sub>	43.200	16.350

- ✓ Fulfilment of EU regulations for air emission reduction
- ✓ Reduction of cross-border sulphur transport
- ✓ Air quality improvement around power plants
- ✓ Reduction of the number of people with respiratory illnesses

# Environmental Protection (3)

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## PROJECTS

- Reconstruction or replacement of existing ESPs on TPP units
- Primary measures for NO<sub>x</sub> emission reduction from TPP units
- Flue gas desulphurization on TPP units (FGD)
- Reconstruction of ash and slag handling system to the new ash pit – introduction of new technology



# Environmental Protection (4)

## Estimated Implementation Funds

Type of project	Funds (x 10 <sup>3</sup> EUR)
TPP ESP reconstruction	33.000
Primary measures for NO <sub>x</sub> emission reduction	48.000
Flue gas desulphurization	545.000
Reconstruction of the existing ash and slag handling technology to the ash pit and introduction of new technology	40.000
<b>Total</b>	<b>677.000</b>

# TRANSMISSION SYSTEM

- Basic Information -

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**Company:**

**EMS<sup>2</sup> – independent, state-owned**

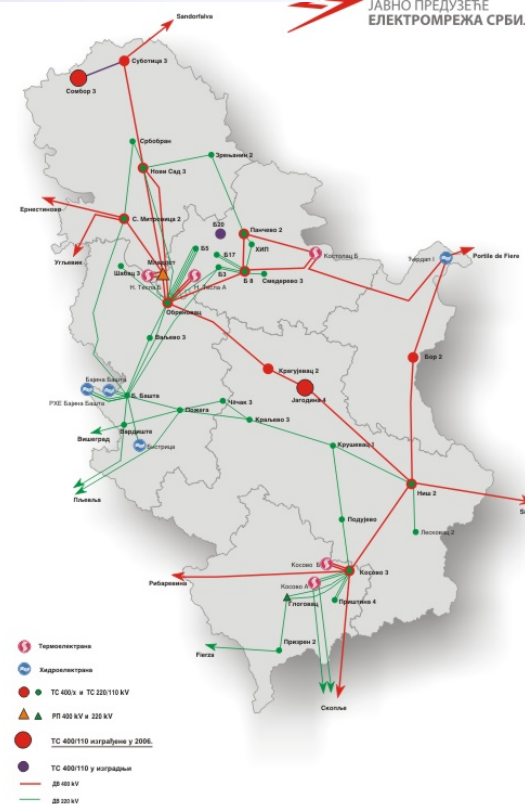
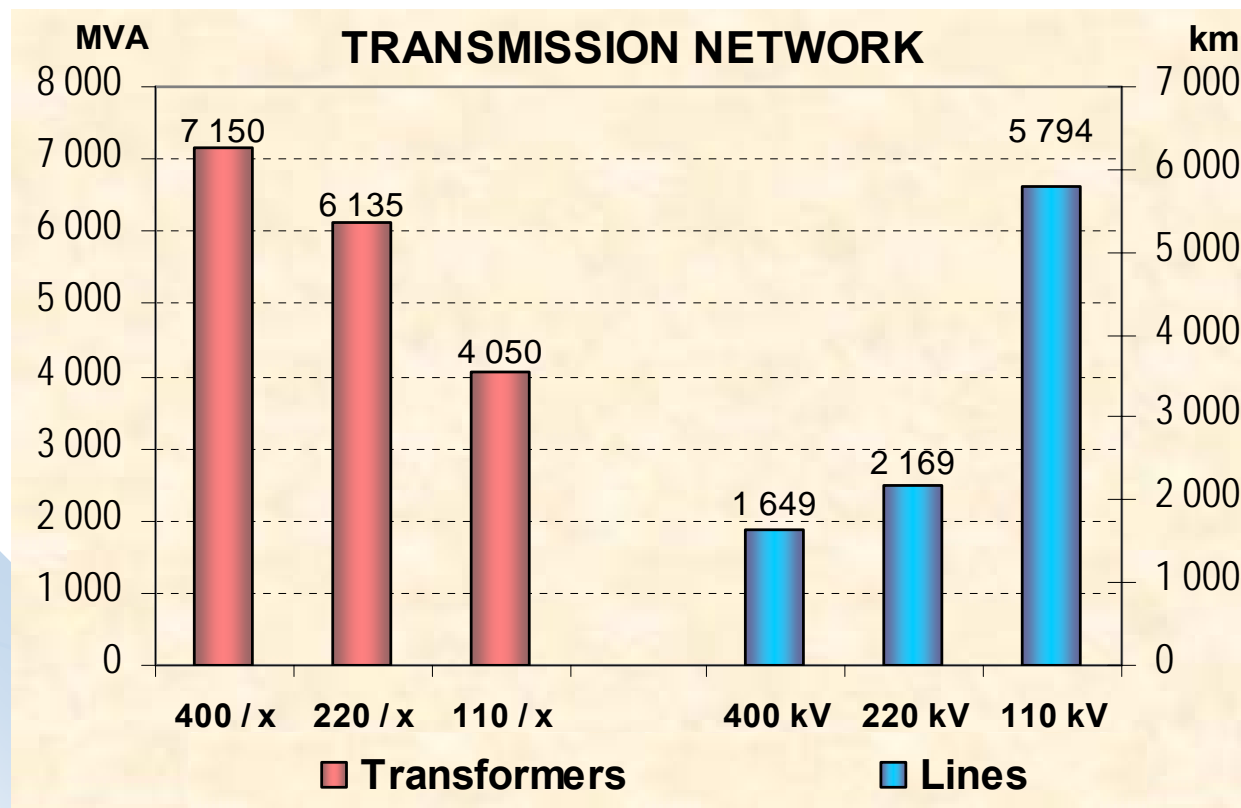
[www.ems.co.yu](http://www.ems.co.yu)

**TSMO:**

- Transmission Network
- System Operator
- Market Operator

**2 - EMS – Electric Network of Serbia**

# Transmission infrastructure (1)



ЈП Електромрежа Србије, Кнеза Милоша 11, 11000 Београд, Тел: 011/33 30 700, [www.ems.co.yu](http://www.ems.co.yu)

**2006:**

**Electricity delivered: 45,834 GWh**

**In-flow 8,567 GWh**

**Losses: 2.75%**

**Out-flow 8,489 GWh**

# Transmission infrastructure (2)

## Development program

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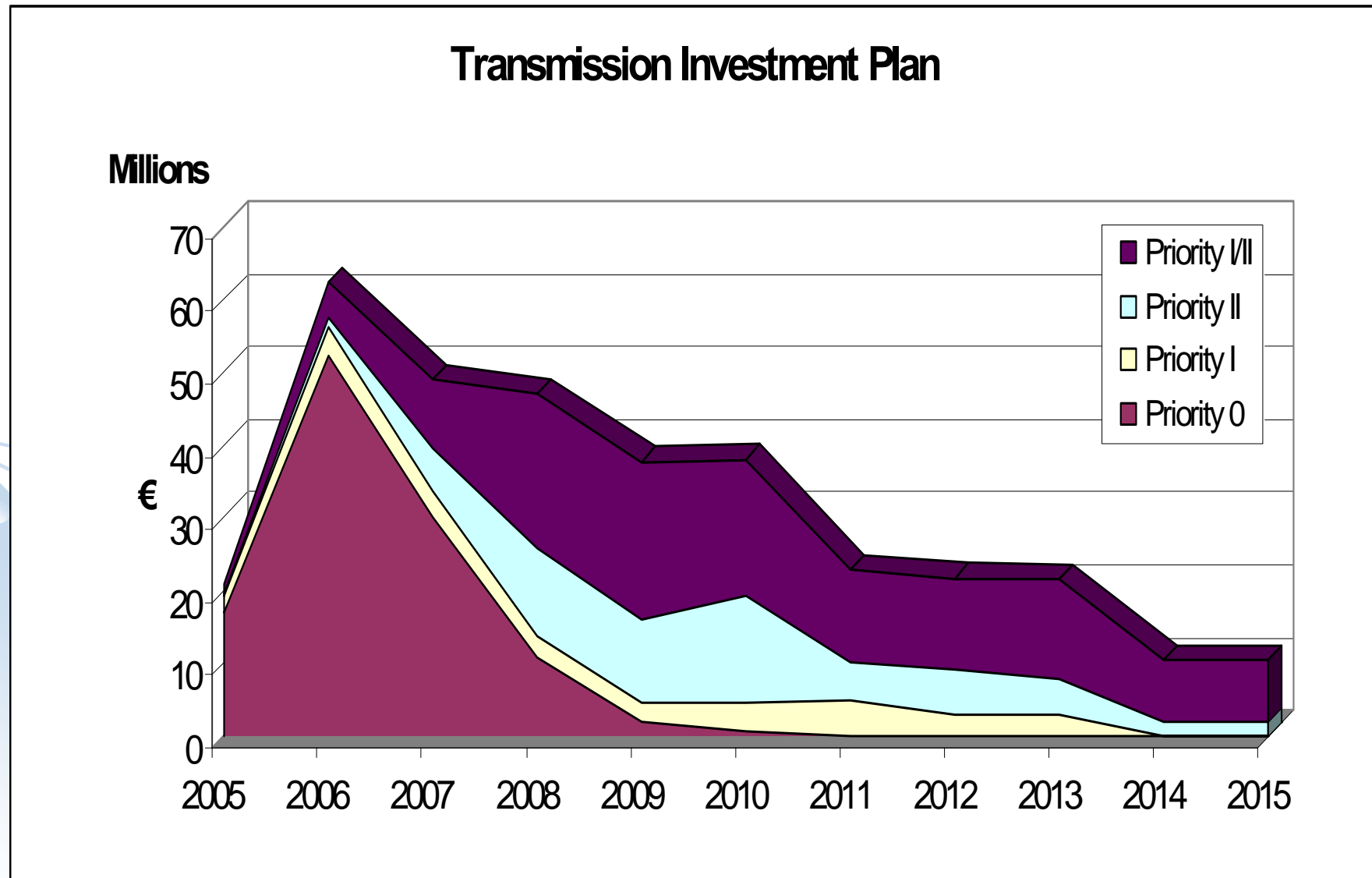
### The main areas of EMS Investment and Development Plan:

- **Transmission system**  
Rehabilitation and Construction
- **IT**
- **Telecommunications**
- **Other investments**

**Estimated Costs of investments till 2015**  
- 400 m € (in 4 levels of priority).



# Transmission infrastructure (3)



# DISTRIBUTION SYSTEM

## - Basic Information -

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### Company:

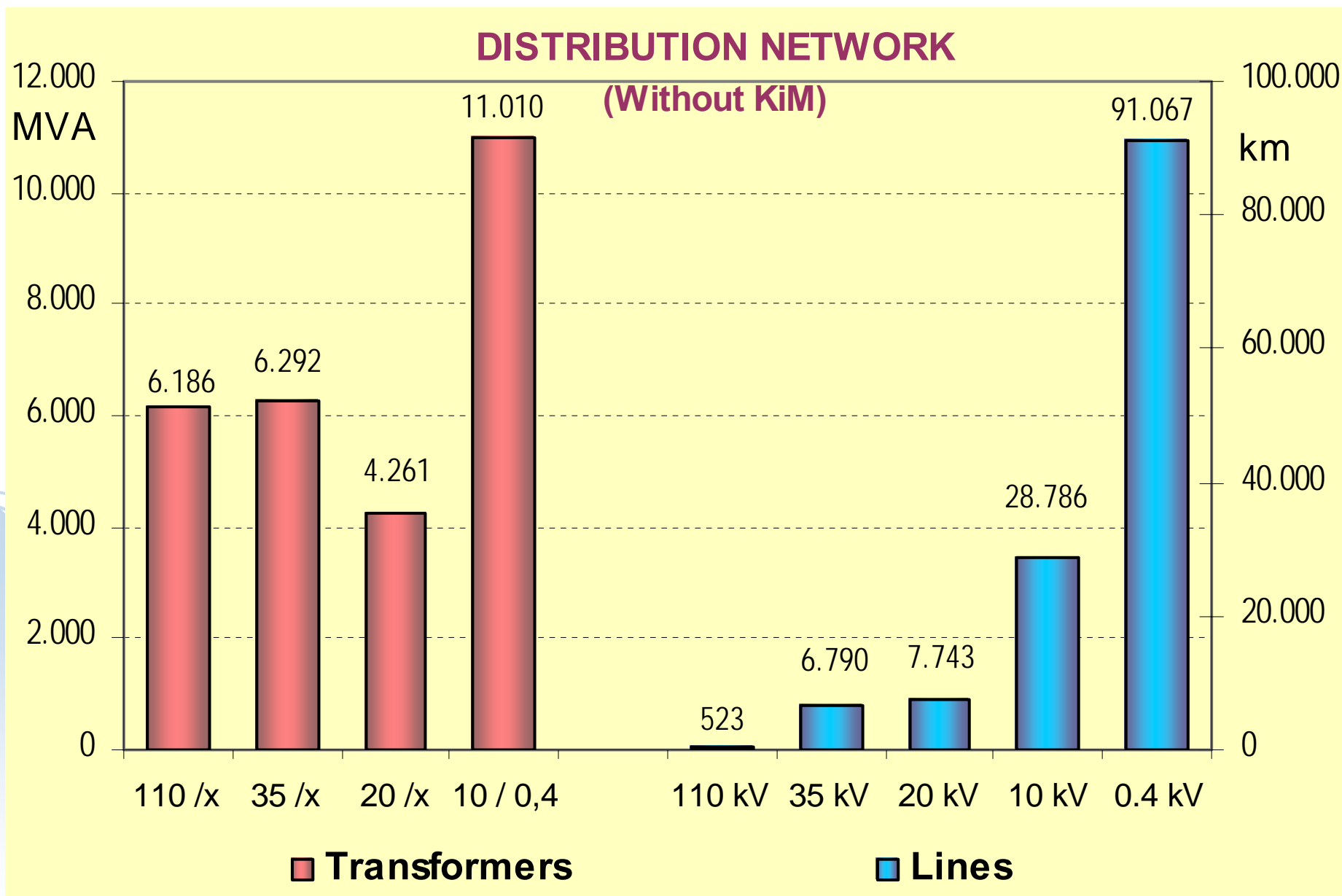
**EPS** - state-owned, vertical integrated Holding

[www.eps.co.yu](http://www.eps.co.yu)

5 Distribution Companies, responsible for

- Distribution Network
- Distribution Operator
- Retail for tariff customers

# Distribution infrastructure





# Distribution companies (1)

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- 3,3 mill consumers (without KiM)
  - 21% of market is potentially opened for 350 consumers with annual consumption  $> 3$  GWh);
- consumers are not interested in market due to low prices for tariff customers.



# Distribution companies (2)

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## 2006:

- Delivered to customers in Serbia **26 933 GWh**
- The biggest share - households 53%
- High level of **losses >13%** – Programme for reduction of technical losses
- Low level of voltage in 0.4 kV network
- The **metering system modernization** programme - almost three million meters are to be replaced within the following ten years; 2006 international tender (the EBRD loan) – 130,000 meters were purchased

# Resime

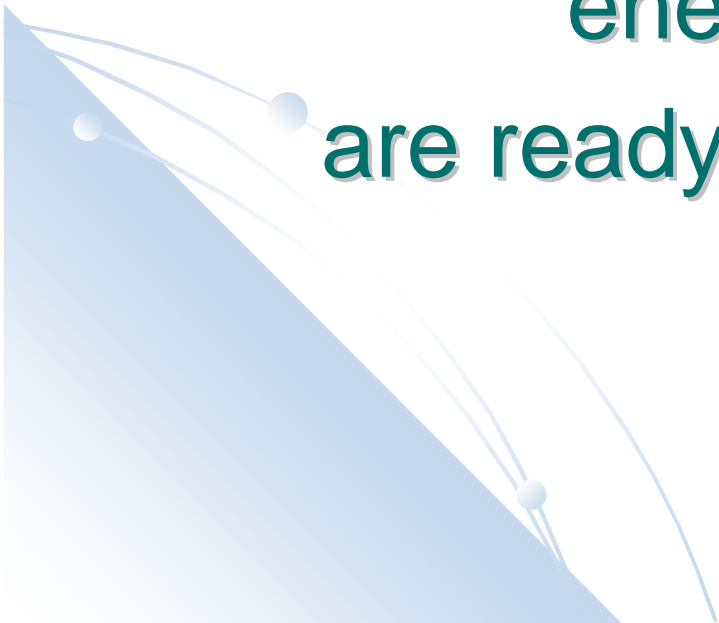
The troubles are behind us !

The Regulator

and

energy enterprises

are ready for new challenges !



***Thank you for your attention!***



***Ljiljana Hadzibabic***

Head of the Technical Department

**Energy Agency of the Republic of Serbia**

**Belgrade, Terazije 5/V**

**Phone: +381 11 30 33 829**

**Fax: + 381 11 32 25 780**

**[www.aers.org.yu](http://www.aers.org.yu)**