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 29th, 2007
Energy Resources and Security of Supply in Serbia:
Energy Balances and Infrastructure Development

1. **Generation** infrastructure expansion:
   Progress and challenges

2. **Transmission** infrastructure expansion:
   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 and Montenegro
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

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)

Primary energy import demand

- 2003
- 2006
- 2009
- 2012
- 2015

M toe

Coal
Oil
Natural gas
Electricity
Company:
**EPS** - state-owned, vertical integrated Holding

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 -

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

2006:
- Generation: 38.5 TWh
- Gross Consumption: 37.1 TWh
- Import: 0.9 TWh
- Export: 2.1 TWh
- Transit: 6.0 TWh
- Lignite Production: 36.1 mill t

* - KiM – Kosovo and Metohija, under UNMIK responsibility
Generation infrastructure
Structure of Power Generation (without KiM)

7155 MW (+ 1200 MW at KiM)

- Pumped-storage PP: 8.6%
- HPPs with reservoir: 5.2%
- Run-of-river HPPs: 25.8%
- TPP-HP: 4.9%
- TPP: 55.5%

Lignite
New capacities
preconditions for construction

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
– concesion

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

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)

GWh

TP P - H P s

Consumption

TPP  TPP-HPs  HPP  Consumption
Balance 1990 - 2006 (with KiM)

GWh

TPP
TPP-HPs
HPP
Consumption
Balance 2006
(without KiM)

Monthly Consumption - Max/Min = 1.63
Max Peak Load / Generation Capacity
1818 = 500 MW

Power System

UCTE
Oct 2004
Serbia’s Power System

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
Average age of

TPPs – 28 years,

HPPs – 34 years,

The basic equipment in open-pit mines – 25 years
Problems in the period 1990 – 2000

- INTERNATIONAL SANCTIONS
  - Lack of liquid fuels and natural gas
  - Lack of money for sustainable development
  - Lack of spare parts for maintenance

- DETERIORATED AND OBSOLETE 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
Average Annual Investment

mil. USD

1976-80: 500
1981-85: 450
1986-90: 300
1991-95: 100
'96-2000: 50
2001-06: 100

24
Key Policy Goals after October 2000

- 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

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)
Annual Maintenance

mil. USD

'94 '95 '96 '97 '98 '99 '00 '01 '02 '03 '04 '05 '06

EKi

Ki'

Ki. parc.
Development and Investments (1)

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

Gross Consumption (without KiM)

TWh

'90.  '92.  '94.  '96.  '98.  '00.  '02.  '04.  '06.  '08.  '10.  '12.  '14.
Development and Investment (3)

- 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)

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)

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

Development and Investment (7)
Energy Resources

Total 17300 GWh/god.
Nonactivated 7100 GWh/god.

Danube
Drina
Morava
Lim
Drim
Smal HPP, P < 10 MW
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

Power and energy balance

import-export energy GWh
power MW
Electricity used for heating
during winter seasons 1990/’91 - 2005/’06

1000 MW for heating!

-24 % max

14%

22% yearly generation

0.8 c$

6819

5204
Improvement of Energy Efficiency

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)

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

<table>
<thead>
<tr>
<th></th>
<th>Without modernisation</th>
<th>After modernisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dust</td>
<td>66.900</td>
<td>5.850</td>
</tr>
<tr>
<td>SO$_2$</td>
<td>360.440</td>
<td>40.720</td>
</tr>
<tr>
<td>NO$_x$</td>
<td>43.200</td>
<td>16.350</td>
</tr>
</tbody>
</table>

- 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)

PROJECTS

– Reconstruction or replacement of existing ESPs on TPP units
– Primary measures for NOx 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

<table>
<thead>
<tr>
<th>Type of project</th>
<th>Funds (x 10^3 EUR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPP ESP reconstruction</td>
<td>33.000</td>
</tr>
<tr>
<td>Primary measures for NO\textsubscript{x} emission reduction</td>
<td>48.000</td>
</tr>
<tr>
<td>Flue gas desulphurization</td>
<td>545.000</td>
</tr>
<tr>
<td>Reconstruction of the existing ash and slag handling technology to the ash pit and introduction of new technology</td>
<td>40.000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>677.000</strong></td>
</tr>
</tbody>
</table>
TRANSMISSION SYSTEM
- Basic Information -

Company:
EMS² – independent, state-owned
www.ems.co.yu

TSMO:
- Transmission Network
- System Operator
- Market Operator
Transmission infrastructure (1)

2006:
Electricity delivered: 45,834 GWh
Losses: 2.75%

In-flow 8,567 GWh
Out-flow 8,489 GWh
Transmission infrastructure (2)  
Development program

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)

Transmission Investment Plan

 Millions

€

Priority I/II
Priority II
Priority I
Priority 0

DISTRIBUTION SYSTEM
- Basic Information -

Company:
EPS - state-owned, vertical integrated Holding
www.eps.co.yu

5 Distribution Companies, responsible for
- Distribution Network
- Distribution Operator
- Retail for tariff customers
Distribution infrastructure

DISTRIBUTION NETWORK
(Without KiM)

MVA

km

Transformers

Lines

110 /x 35 /x 20 /x 10 / 0,4

110 kV 35 kV 20 kV 10 kV 0.4 kV

6.186 6.292 4.261 11.010 523

5.261 7.743 28.786 91.067

60.000

100.000
Distribution companies (1)

- 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)

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
Resume

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