SECURITY OF SUPPLY STATEMENT OF THE REPUBLIC OF SERBIA

Prepared by the Ministry of Mining and Energy

Belgrade, August 2009
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1. ELECTRICITY

First chapter describes key electricity market participants and their responsibilities relating to security of supply and present regulatory framework for electricity production, transmission and distribution investments. Public service obligation is treated with special attention. This is then followed by description of existing and planned production capacities, incentives for new production capacities construction, existing, and planned electricity network capacities with particular reflection on the cross-border transmission capacities and transmission network access and management. Finally, there is a presentation of achievements and planned methods to satisfy electricity demand needs in the Serbian power system.

1.1. Key market participants and their responsibilities

The Ministry of Mining and Energy, according to the Law on Ministries (2008), is responsible for the Energy balance of the Republic of Serbia, power, oil and gas industry, safe pipeline transport of gas and liquid hydrocarbons. It also undertakes the measures in order to secure the conditions for the functioning of the public enterprises in the fields of energy.

The Energy Agency was established by the Energy Law (Official Gazette 84/04, 2004). The Agency was established as a regulatory body for performing the following tasks: enhancing and directing the development of the energy market in accordance with the principles of non-discrimination and effective competition, monitoring the implementation of regulations and energy systems operating codes, harmonizing the activities of energy entities in providing regular supply of energy and services to customers and ensuring their protection and equal treatment. The Agency is functionally independent from any government bodies, all energy entities and users of their products and services, as well as other legal and physical persons. The Agency was legally and organizationally established in 2005.

Public Enterprise for electricity transmission and transmission system control “Elektromreža Srbije” (Serbian Transmission System and Market Operator) was established by the Government of the Republic of Serbia as an independent public enterprise from July 1, 2005. Main activities of the company are electricity transmission, transmission system control and organization of electric energy market.

Public Enterprise “Elektroprivreda Srbije” (PE EPS) was established by the same Decision of the Government of Serbia which entered into force on 1 July 2005. Main activities of the company are electricity production and distribution, as well as trade and supply of electricity.

1.2. Regulatory framework for production, transmission and distribution investments
Serbian regulatory framework for power production, transmission and distribution is based on following strategic documents:

- Energy Law (Official Gazette 84/04, 2004),
- Serbian Energy Development Strategy until 2015 (Official Gazette 44/05, 2005)
- Programmes for Energy Strategy Implementation (updated on two years period)

There are three adopted tariff methodologies within the Serbian power system. Tariff system for the electricity transmission system access and utilization (Official Gazette RS 001/2007), Tariff system for the electricity distribution system access and utilization (Official Gazette RS 001/2007) and Tariff system for electricity settlement for tariff buyers (Official Gazette 001/2007) are targeted to guarantee adequate level of system security and supply quality.

Serbian Grid Code (Official Gazette RS 055/2008) is based on Article 94 of the Energy Law and Article 32 of the PE EMS statute. Terms regulated with the Grid Code includes:

- Planning the transmission system,
- Connecting the transmission system,
- Access to the transmission system,
- Operation of transmission systems,
- Operation and maintenance of facilities,
- Measurement of the electrical energy.

Annual energy needs forecasting is subject of the Energy balance, instrument which is under the Ministry of Mining and Energy jurisdiction.

Existing regulatory framework encourage private investments in electricity production capacities (conventional as well as renewable) and allows third party access.

### 1.3. Public service obligation

As of February 2008, according to the Decision of the Energy Agency of the Republic of Serbia, any non-household customer may acquire the status of an eligible electricity customer regardless of the annual consumption. These customers can freely choose their electricity suppliers. This decision potentially opens around 47% of the electricity market. Previous eligibility threshold amounted to 3GWh annual consumption qualified 350 large electricity customers.

However, up to date no qualified electricity customers applied for eligible customer status due to low electricity price provided by PE EPS.

With previous decision the Agency met its obligations from the Energy Community Treaty (all non-household customers shall receive eligible customer status as of 2008). Following the provisions of the Treaty, household customers will acquire eligible customer status as of 2015.
1.4. Production capacities

1.4.1. Existing power plants

Existing capacities for electricity production in Serbia include:

- Hydro power plants,
- Thermal power plants (coal, heating oil, natural gas),
- Combined heat and power plants
- Small hydropower plants
- Industrial power plants and District heating CHP.

Due to lack of independent producers, Serbian electricity market is dominantly supplied by Public Enterprise “Electric power industry of Serbia” (PE EPS)

PE EPS is divided into Economic Associations (EA) EA for coal and electricity production and EA for electricity distribution.

The total capacity of nine hydro power plants (HPPs) with fifty hydro units is 2,831 MW, which makes almost 34% of EPS's total electric power potential. All HPPs are organized in two EA:

EA HPP “Djerdap”:
- HPP Djerdap I (with 6 units)
- HPP Djerdap II (with 10 units)
- HPP Pirot (with 2 units)
- HPP Vlasina (with 10 units)

EA HPP “Drinsko-limske”:  
- HPP Bajina Basta (with 4 units)
- RHPP Bajina Basta (with 2 units) – reversible HPP
- HPP Limske (with 8 units)
- HPP Zvornik (with 4 units)
- HPP Elektromorava (with 4 units)

The aggregate capacity of eight thermal power plants (TPPs) with 25 blocks is 5,171 MW, using lignite as a fuel. Similarly all TPPs are organized in three EA:

EA TPP “Nikola Tesla”:
- TPP Nikola Tesla A (with 6 blocks)
- TPP Nikola Tesla B (with 2 blocks)
- TPP Kolubara (with 5 blocks)
- TPP Morava (with 1 block)

EA TPP and mines “Kostolac”:
- TPP Kostolac A (with 2 blocks)
- TPP Kostolac B (with 2 blocks)

TPP Kosovo (As of 1 July 1999, EPS does not operate its facilities on the territory of Kosovo and Metohia)
- TPP Kosovo A (with a total of 5 blocks)
- TPP Kosovo B (with a total of 2 blocks)
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Total capacity of all CHP Plants is 353 MW organized in single EA CHPP “Panonske”:
- CHPP Novi Sad (with 2 blocks)
- CHPP Zrenjanin (with 1 block)
- CHPP Sremska Mitrovica (with 3 blocks)

Geographical distribution of existing power plants is presented on following figure. Figure 1:
1.4.2. Operational security

Serbian installed power system consists of 33% hydro power plants (some with daily regulation, some with seasonal regulation and one reversible hydro power plant). Around 62% of installed capacity is in lignite-fired thermal power plants. Due to lack of regular maintenance during period 1990-2000, TPPs were main threat of power system operational security. However, reliability of Serbian thermal power plants is significantly improved in last 8 years. Forced slowdowns are reduced from 19.5% on 2000 to 5.3% on 2008 (Figure 2).

Figure 2. Structure of Serbian thermal power plants (non) operating conditions

Significant utilization improvement is achieved on TPP Kolubara (from 19.9% to 50.8%) and TPP Kostolac A (from 15.6% to 75.8%) which is presented on Figure 3.

Figure 3. TPPs utilization factor
1.4.3. Construction of new production facilities and rehabilitation of existing facilities

New power plant construction requires significant investments. Serbian regulatory framework provides background for local and international investors to invest in power generation projects. Majority of the projects described below will be realized jointly with international partners.

Thermal Power Plants:

Following rehabilitation and modernization activities are foreseen by 2012:

- rehabilitation and modernization of TPP Nikola Tesla A6 (continuation of started activities)
- rehabilitation and modernization of TPP Kostolac B (on 2010)
- non-standard repairs on TPP Nikola Tesla B2, TPP Kolubara A3, TPP Kolubara A5, TPP Nikola Tesla A3-A5and TPP Kostolac A

The oldest TPPs will be removed from normal operation (Kolubara A1, A2 and A4) from environmental and operation costs reasons, after 2012.

Finally, the process of the construction of new thermal power plants is in progress:

- TPPs that will utilize domestic lignite (necessary documentation prepared, approved decision for projects construction, strategic partner will be selected in 2009, expected finalization in 2013) which are:
  - TPP Kolubara B (2 x 350 MW),
  - TPP Nikola Tesla B3 (new 744 MW unit in existing TPP Nikola Tesla B)
- TPP that will use low caloric lignite with circulating fluidized bed boilers. Preparation of financing and technical documentation is in progress.
- TPP Novi Sad: construction of natural gas fired CHP plant is foreseen. Tender is prepared and will be published in the second half of 2009.

Conventional hydro power plants

Planned or started revitalization and modernization of existing conventional hydro power plants up to 2012 will increase installed power and annual energy production. Most important foreseen activities are:

- Revitalization of the HPP Djeerdap 1: According to the contract with Russian company “Silovie masini”, flow will be increased from 800 to 840 m3/s, and will increase installed power from 176 MW to 205 MW. With proposed revitalization HPP life time should be extended for another 30 years. Foreseen end of revitalization is in 2015.
- Revitalization of the HPP Djeerdap 2 (all units)
- Revitalization of HPP Ovcar Banja and Medjuvrsje.
- HPP Bajina Basta – Extension of plant’s life time for 30 years is foreseen with installed power increasing of 28 MW. Unit A1 will be in operation until March 2010 while units A2, A3, and A4 will be revitalized by the end of 2012.

Upgrade of existing HPPs is also foreseen:

- HPP Pirot (increasing of available water accumulation);
- HPP Bajina Basta (installation of new unit);
1.4.4. Incentives for new production capacities (RES and EE)

Final proposal of feed-in tariff was prepared on summer 2009 and most probably will be adopted by Serbian government in September 2009 (Table 1, Figure 4). Proposed tariffs will be valid on 12 years time horizon with fixed amount in Euro. Jointly with feed-in tariff preparation standardized long-term power purchase agreement and methodology for privileged energy producer status granting is developed too.

Table 1. Proposal of feed-in tariff in Serbia

<table>
<thead>
<tr>
<th>#</th>
<th>Plant type</th>
<th>Installed power P (kW)</th>
<th>Price (c€/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Small Hydro Power Plants</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.1 Greenfield Up to 500 kW</td>
<td></td>
<td>9,7</td>
</tr>
<tr>
<td></td>
<td>1.2 Greenfield From 500 kW up to 2 MW</td>
<td>10,316 – 1,233*P</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.3 Greenfield From 2 MW up to 10 MW</td>
<td>7,85</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.4 On existing infrastructure</td>
<td>Up to 10 MW</td>
<td>5,9</td>
</tr>
<tr>
<td></td>
<td>1.5 On waterworks system</td>
<td>Up to 10 MW</td>
<td>3,8</td>
</tr>
<tr>
<td>2</td>
<td>Biomass Plants</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.1 Greenfield Up to 500 kW</td>
<td></td>
<td>13,6</td>
</tr>
<tr>
<td></td>
<td>2.2 Greenfield From 500 kW up to 5 MW</td>
<td>13,845 – 0,489*P</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.3 Greenfield From 5 MW up to 10 MW</td>
<td>11,4</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Biogas Power Plants</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.1 Greenfield Up to 200 kW</td>
<td></td>
<td>16,0</td>
</tr>
<tr>
<td></td>
<td>3.2 Greenfield From 200 kW up to 2 MW</td>
<td>16,444 – 2,222*P</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.3 Greenfield Over 2 MW</td>
<td></td>
<td>12,0</td>
</tr>
<tr>
<td>4</td>
<td>Landfill and Sewage Gas Power Plants</td>
<td></td>
<td>6,7</td>
</tr>
<tr>
<td>5</td>
<td>Wind power plants</td>
<td></td>
<td>10,5</td>
</tr>
<tr>
<td>6</td>
<td>Photo Voltaic (Solar) Power Plants</td>
<td></td>
<td>35,4</td>
</tr>
<tr>
<td>7</td>
<td>Geothermal Power Plants</td>
<td></td>
<td>7,5</td>
</tr>
<tr>
<td>8</td>
<td>Fossil Fuel Based Combined Heat and Power Plants</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8.1 Greenfield Up to 200 kW</td>
<td>C₀ = 10,4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8.2 Greenfield From 200 kW up to 2 MW</td>
<td>C₀ = 10,667–1,333*P</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8.3 Greenfield From 2 MW up to 10 MW</td>
<td>C₀ = 8,2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8.4 On existing infrastructure</td>
<td>Up to 10 MW</td>
<td>C₀ = 7,6</td>
</tr>
<tr>
<td>9</td>
<td>Solid Waste Power Plants</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9.1 Greenfield Up to 1 MW</td>
<td></td>
<td>5,3</td>
</tr>
<tr>
<td></td>
<td>9.2 Greenfield From 1 MW up to 10 MW</td>
<td>4,9</td>
<td></td>
</tr>
</tbody>
</table>

Correction of electricity price for natural gas based combined heat and power plants

\[ C = C₀ \ast (0,7 \ast G / 31 + 0,3) \]

C – new electricity price
C₀ – baseline natural gas price (31 CSD/m³)
G (CSD/m³) – new natural gas price
1.5. Power grid capacities

1.5.1. Transmission network

Table 2 Transmission lines in PE EMS

<table>
<thead>
<tr>
<th>Transmiss. Unit</th>
<th>Line 10 kV</th>
<th>Lines 35 kV</th>
<th>Lines 110 kV</th>
<th>Lines 220 kV</th>
<th>Lines 400 kV</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(km)</td>
<td>single (km)</td>
<td>double (km)</td>
<td>single (km)</td>
<td>double (km)</td>
<td></td>
</tr>
<tr>
<td>Beograd</td>
<td>4.73</td>
<td>43.52</td>
<td>738.35</td>
<td>496.76</td>
<td>227.94</td>
<td>85.48</td>
</tr>
<tr>
<td>Zaječar</td>
<td>28.64</td>
<td>34.69</td>
<td>426.02</td>
<td>40.50</td>
<td>-</td>
<td>234.79</td>
</tr>
<tr>
<td>Valjevo</td>
<td>26.95</td>
<td>168.25</td>
<td>78.21</td>
<td>4.974.30</td>
<td>855.48</td>
<td>1.781.98</td>
</tr>
<tr>
<td>Krusevac</td>
<td>4.04</td>
<td>107.91</td>
<td>1206.21</td>
<td>35.16</td>
<td>305.48</td>
<td>395.94</td>
</tr>
<tr>
<td>Novi Sad</td>
<td>1.303.20</td>
<td>49.83</td>
<td>49.83</td>
<td>49.83</td>
<td>49.83</td>
<td></td>
</tr>
<tr>
<td>Obilic (EMS)</td>
<td>562.59</td>
<td>6.38</td>
<td>286.80</td>
<td>179.56</td>
<td>1.035.33</td>
<td></td>
</tr>
<tr>
<td>Obilić (UMNIK)</td>
<td>4.04</td>
<td>168.25</td>
<td>78.21</td>
<td>4.974.30</td>
<td>855.48</td>
<td>1.646.78</td>
</tr>
<tr>
<td>EMS without Kosovo</td>
<td>4.04</td>
<td>168.25</td>
<td>78.21</td>
<td>4.974.30</td>
<td>855.48</td>
<td>1.781.98</td>
</tr>
<tr>
<td>Total</td>
<td>4.04</td>
<td>168.25</td>
<td>78.21</td>
<td>4.974.30</td>
<td>855.48</td>
<td>2.068.78</td>
</tr>
</tbody>
</table>
Existing transmission (400 kV, 220 kV) lines are presented on Figure 5.

Table 3. Transformer stations in PE EMS

<table>
<thead>
<tr>
<th>Transm. Unit</th>
<th>400/X kV/kV</th>
<th>220/X kV/kV</th>
<th>110/X kV/kV</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td># of stations (pieces)</td>
<td># of transform (pieces)</td>
<td>Installed power (MVA)</td>
<td># of stations (pieces)</td>
</tr>
<tr>
<td>Beograd</td>
<td>6</td>
<td>7</td>
<td>2,600</td>
<td>5</td>
</tr>
<tr>
<td>Bel</td>
<td>2</td>
<td>1</td>
<td>150</td>
<td>9</td>
</tr>
<tr>
<td>Valjevo</td>
<td>5</td>
<td>8</td>
<td>1,081,5</td>
<td>9</td>
</tr>
<tr>
<td>Kruševac</td>
<td>3</td>
<td>6</td>
<td>983</td>
<td>19</td>
</tr>
<tr>
<td>Novi Sad</td>
<td>4</td>
<td>6</td>
<td>2,000</td>
<td>19</td>
</tr>
<tr>
<td>Obilić</td>
<td>1</td>
<td>2</td>
<td>800</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>16</strong></td>
<td><strong>22</strong></td>
<td><strong>7,450</strong></td>
<td><strong>56</strong></td>
</tr>
</tbody>
</table>

In last 5-6 years efficiency of transmission network is significantly improved. Starting form 2000 delivered energy grows permanently while transmission energy losses decrease (Figure 6)
Monthly values of undelivered energy (caused by system element outage) for 2008 are presented in the following table:

<table>
<thead>
<tr>
<th>Month</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>(MWh)</td>
<td>93</td>
<td>357</td>
<td>71</td>
<td>114</td>
<td>125</td>
<td>217</td>
<td>204</td>
<td>162</td>
<td>210</td>
<td>43</td>
<td>262</td>
<td>106</td>
</tr>
</tbody>
</table>

Highest values for undelivered energy were recorded on February, September and November which correspond to faults in TS Belgrade, TS Subotica and TS Novi Sad. Also increasing in undelivered energy amounts during summer season is caused by intensive thunders. Total undelivered energy for 2008 was 1,964 MWh while delivered one was 33,838,000 MWh, which means that annual reliability parameter for 2008 was 99.994%.

Analysis for 2008-2012 period estimated annual grow of energy consumption of 1.8% and grow of peak power of 1%. Based on that analyses following transmission network projects are prioritized:

| Table 4 List of prioritized transmission network projects  
(TS – transformer station, OL – overhead line) |
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TS 400/220/110 kV Nis 2</td>
</tr>
<tr>
<td>TS 400/220 kV Beograd 8</td>
</tr>
<tr>
<td>TS 400/220/110 kV Novi Sad 3</td>
</tr>
<tr>
<td>Reconstruction of plant’s transformer stations in Obrenovac, Mladost, TS Bajina Basta, Djeraded</td>
</tr>
<tr>
<td>Replacement of 400 kV equipment and transformers</td>
</tr>
<tr>
<td>Replacement of OL 220 kV with OL 400 kV</td>
</tr>
<tr>
<td>TS 400/220/110 kV Leskovac 2</td>
</tr>
<tr>
<td>TS 400/220/110 kV Smederevo 3</td>
</tr>
<tr>
<td>TS 400/220/110 kV Srbovan</td>
</tr>
<tr>
<td>TS 400/220/110 kV Kraljevo 3</td>
</tr>
<tr>
<td>TS 400/220/110 kV Bajina Bašta</td>
</tr>
<tr>
<td>TS 400/220/110 kV Zrenjanin</td>
</tr>
<tr>
<td>TS 400/220/110 kV Šabac</td>
</tr>
<tr>
<td>TS 400/110 kV Beograd 20</td>
</tr>
<tr>
<td>TS 400/110 kV Vranje 4</td>
</tr>
<tr>
<td>OL 400 kV Sombor 3 – Pećuj</td>
</tr>
<tr>
<td>OL 400 kV Kraljevo 3–Kragujevac 2</td>
</tr>
<tr>
<td>OL 400 kV Nis 2 – Leskovac 2 – Vranje 4 – Skopje</td>
</tr>
<tr>
<td>OL 400 kV Srbija - Rumunija</td>
</tr>
<tr>
<td>OL 400 kV Mladost – Sremska Mitrovica 2</td>
</tr>
</tbody>
</table>

Some of the most important implemented projects in past two years were:
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- Extension of TS Sremska Mitrovica: project includes addition of 400/220 kV transformation into exiting TS 220/110 kV in order to improve voltage profile in Vojvodina province and reduce transmission network losses.
- Construction of 400 kV TS Jagodina 4 which improves supply of several cities and reduce transmission losses.
- Construction of TS Sombor 3 and 400 kV overhead line Sombor 3 – Subotica to improve voltage profile and reduce transmission losses.
- Construction of 400 kV overhead line TS Sremska Mitrovica 2 – TPP Ugljevik improve connection between transmission networks of Serbia and Bosnia and Herzegovina.
- Extension of TS 220/110 kV Smederevo 3 (installation of second transformer) to improve supply security for large industrial consumers (US Steel Serbia, Messer-Tehnogs).
- Installation of SCADA/EMS and SRAAMD (System for Remote Acquisition and Accounting of Metering Data). Additional improvements on telecommunication system are necessary.

1.5.2. Distribution network

Economic Association (EA) for Electric Energy distribution is integral part of Serbian Power System Company EPS. EA for electricity distribution is divided into 5 distribution companies, presented on the Figure 7.
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Figure 7. Distribution companies in the Republic of Serbia

Basic information on distribution facilities (transformer stations and lines) are shown on Figure 8.

1.6. Electricity production and system peak load

Electricity consumption in the Republic of Serbia permanently grows in last 10 years. However, improved power plant maintenance reduces unavailability of the production unit and significantly increased electricity production (Figure 9).

Figure 8. Distribution facilities

Figure 9. Production structure and gross consumption 2000 - 2008
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Electricity exchange (including transit) with neighboring systems is significant. Electricity income mostly comes from north and east (Hungary, Romania, and Bulgaria) while electricity outcome goes to the west and south (Croatia, Bosnia and Herzegovina, Montenegro, Albania, and FYR of Macedonia) – Figure 10a. Electricity balance is presented on Figure 10b. Exchange capacities are calculated on annual and monthly basis. Main security criteria is N-1 with mathematical model of Romania, Bulgaria; Greece, FYRoM, Albania, Montenegro, Bosnia and Herzegovina, Croatia, Serbia, Hungary, Ukraine, Slovenia, Austria, and Italy.

**Average monthly NTC for import direction in 2008 (MW)**

<table>
<thead>
<tr>
<th></th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
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**Average monthly NTC for export direction in 2008 (MW)**

<table>
<thead>
<tr>
<th></th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
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<td>107</td>
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<td>103</td>
<td>146</td>
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<tr>
<td>RS-ME</td>
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<td>441</td>
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<td>RS-BA</td>
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<td>277</td>
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<td>300</td>
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<td>200</td>
<td>250</td>
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</table>
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Figure 10 (a) Diagram of electricity exchange and (b) Electricity balance for 2008

Seasonal variations of load diagram as well as monthly peak hours are presented on Figure 11.

Figure 11. (a) Monthly consumption and (b) peak hours in 2008

1.7. Electricity supply

Forecasting of peak power and energy needs for Serbian power system is presented in strategic documents (Energy Strategy and Programme for Energy Strategy Implementation). Most important figures are presented in the following tables and diagrams.
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Energy needs and peak power forecasting

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<thead>
<tr>
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<td>33,351</td>
<td>33,844</td>
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<td>Power (MW)</td>
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<td>6,275</td>
<td>6,360</td>
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</table>

Energy needs forecast for period 2003 - 2015

Peak power forecast for period 2003 - 2015
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As of February 23, 2008, according to the Decision of the Energy Agency of the Republic of Serbia any non-household customer may acquire the status of an eligible electricity customer regardless of the annual consumption.

For non-eligible customers Serbian tariff system (Official Gazette RS 001/2007) is applicable. Last prices adjustment was done on August 1st, 2008. According to the tariff system all non-eligible customers are divided in five categories (Table 5)

Table 5. Tariff system for tariff (non-eligible) consumers

<table>
<thead>
<tr>
<th>Consumption Category</th>
<th>Tariff elements</th>
<th>Unit</th>
<th>Daily tariff rate (CSD/unit)</th>
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</thead>
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<tr>
<td>High voltage</td>
<td>Metering point fee</td>
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<td>95.83</td>
</tr>
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<td></td>
<td>Peak power</td>
<td>kW</td>
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<td>Excessive peak power</td>
<td>kW</td>
<td>794.084</td>
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<td></td>
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<td>kWh</td>
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<tr>
<td></td>
<td></td>
<td>kWh</td>
<td>lower 1.055</td>
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<tr>
<td></td>
<td>Reactive energy (cos φ ≥ 0.95)</td>
<td>kvarh</td>
<td>0.135</td>
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<tr>
<td></td>
<td>Excessive reactive energy (cos φ &lt; 0.95)</td>
<td>kvarh</td>
<td>0.270</td>
</tr>
<tr>
<td>Medium voltage</td>
<td>Metering point fee</td>
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<td>95.83</td>
</tr>
<tr>
<td></td>
<td>Peak power</td>
<td>kW</td>
<td>476.450</td>
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<td></td>
<td>Excessive peak power</td>
<td>kW</td>
<td>952.901</td>
</tr>
<tr>
<td></td>
<td>Active energy</td>
<td>kWh</td>
<td>higher 3.416</td>
</tr>
<tr>
<td></td>
<td></td>
<td>kWh</td>
<td>lower 1.139</td>
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<td></td>
<td>Reactive energy (cos φ ≥ 0.95)</td>
<td>kvarh</td>
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<td>Low voltage</td>
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<td>Active energy</td>
<td>kWh</td>
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<td></td>
<td>kWh</td>
<td>lower 1.501</td>
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<td>Reactive energy (cos φ ≥ 0.95)</td>
<td>kvarh</td>
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<td>Excessive reactive energy (cos φ &lt; 0.95)</td>
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<td>Accounting demand</td>
<td>kW</td>
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<tr>
<td>Residential sector</td>
<td>For consumers with single-tariff metering</td>
<td>Green zone</td>
<td>kWh</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blue zone</td>
<td>kWh</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Red zone</td>
<td>kWh</td>
</tr>
<tr>
<td></td>
<td>For consumers with two-tariff metering</td>
<td>Green zone</td>
<td>kWh</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>kWh</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blue zone</td>
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<tr>
<td></td>
<td></td>
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<td>kWh</td>
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<tr>
<td></td>
<td></td>
<td>Red zone</td>
<td>kWh</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>kWh</td>
</tr>
<tr>
<td></td>
<td>For consumers with controlled metering</td>
<td>Green zone</td>
<td>kWh</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>kWh</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blue zone</td>
<td>kWh</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>kWh</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Red zone</td>
<td>kWh</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>kWh</td>
</tr>
<tr>
<td></td>
<td>For consumers with controlled metering and special metering</td>
<td>Green zone</td>
<td>kWh</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blue zone</td>
<td>kWh</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Red zone</td>
<td>kWh</td>
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<tr>
<td>Public lighting</td>
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<tr>
<td></td>
<td>Active energy</td>
<td>Public lighting</td>
<td>kWh</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Neon signs</td>
<td>kWh</td>
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</table>

Last tariff system considerably supports energy efficiency measures for all consumption categories:
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- Peak power shaving – block tariff for monthly peak power for categories high voltage, medium voltage, and low voltage.
- Reactive energy compensation – block tariff for reactive energy consumption depending on power factor for same categories.
- Load shifting – daily tariff rates (lower 0:00 – 8:00 and higher 8:00 – 24:00) for all categories except street lighting which is already active during night (period of lower consumption) and residential sector with single-tariff metering and special metering.
- Energy saving in residential sector – block tariff for active energy consumption
  - Green zone for consumption block up to 350 kWh/month
  - Blue zone for consumption block between 350 and 1,600 kWh/month
  - Red zone for consumption block above 1,600 kWh/month.

Unfortunately, since last electricity prices adjustment (August 2008), due to global financial crisis, Serbian national currency Dinar (CSD) lost more than 25% of its value compared to Euro.

1.8. Conclusion

Previous chapters confirm that Serbia created and permanently improves instruments for security of supply. Energy Law, Energy Strategy and Programme for Energy Strategy Implementation are good strategic background. Key institution’s and market player’s capacities could assist in supply security improvement in the country and the region.
2. NATURAL GAS

In this chapter key market participants and their responsibilities are analyzed, as well as the relevant regulatory framework and public service obligation. This is followed by a presentation of import, storage, existing and planned capacities of the gas network. In conclusion data is presented about the energy balance and natural gas supply.

2.1. Key market participants and their responsibilities

Legal and regulatory framework for natural gas market has been evolving. The Energy Law came into force in August 2004. The Ministry of Energy and Mining is the responsible body granting authorization for all natural gas facilities construction and refurbishment. The entire gas infrastructure is regulated except from transit to the Bosnia and Herzegovina.

Concerning key market players, Transport system operator is the public enterprise “Srbijagas”, established in 2005 after unbundling the National Oil and Gas Company of Serbia, into three different companies.

The Public Enterprise (PE) “Srbijagas” owns 97% of gas transport network is an undertaking engaging in natural gas transmission, distribution, storage and trade. It develops and modernizes Serbian gas infrastructure and interconnects it to the gas infrastructures of other countries of the region.

Srbijagas activities of public and state interest include:
- Secure supply of natural gas to the market;
- Development and safe operation of the gas transmission, distribution and storage systems;
- Enabling diversification of gas supply routes and sources by interconnecting the Serbian gas transmission system to the gas transmission systems of other countries in the region;
- Implementation of the principle of rational and efficient natural gas utilization, adhering to the principles of environment protection and sustainable development.

Yugorosgaz, a joint venture of Srbijagas (25%), Centrex (25%) and Gazprom (50%), owns 67.5km of high pressure pipelines in southern part of Serbia, i.e. the remaining 3% of transport network.

Concerning distribution, 72% of the market is served by Srbijagas and 28% by 32 other distribution companies with different kind of ownership (private and public) responsible for distribution and supply of natural gas in northern part of Serbia.
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Regarding trade, Srbijagas performs wholesale and retail trade for captive customers (regulated prices) and wholesale trade for the open market, whilst 30 DSOs have been issued licenses for supply for tariff customers in Serbia by the end of 2007.

TPA is regulated according the Energy Law for transmission, storage and distribution and the network code is under preparation. There is negotiated TPA in upstream pipeline network.

2.2. Regulatory framework

In the Serbian gas sector there are three adopted tariff methodologies. Tariff system for natural gas transport system access and utilization (Official Gazette RS 001/2007), Tariff system for natural gas distribution system access and utilization (Official Gazette RS 001/2007) and Tariff system for natural gas settlement for tariff buyers (Official Gazette 001/2007, amended in Official Gazette 021/2008) are targeted to guarantee adequate level of system security and supply quality.

The new price regulation framework for natural gas sector set by Energy Agency is implemented as follows:

- **Natural gas transmission prices**
  - for PE Srbijagas: in force as of October 2008
  - for Yugorosgaz A.D: in force as of February 2009

- **Natural gas distribution prices**
  - for PE Srbijagas: in force as of October 2008
  - for privately or municipally owned distribution companies: in force as of April 2009

- **Natural gas prices for tariff (final) customers:**
  - for PE Srbijagas: in force as of October 2008;
  - for publicly, privately or municipally owned suppliers of tariff customers: in force as of April 2009.

**Licensing**

The licenses for gas activities are granted by the Energy Agency of the Republic of Serbia (AERS), the competent regulatory body for natural gas. The Agency has responsibility for licensing, price regulation (pricing methodologies and tariff systems for transmission, distribution, end-user prices for captive customers as well as methodologies for determination of network connection charges) and dispute resolution (on TPA and connection to networks).

**Market opening**

In 2008 the Council of AERS passed a decision by which all non-household customers could obtain eligibility regardless of annual consumption. The Decision is applied as of February 23rd 2008. The result of this Decision is a potential market opening of 90%. Full market opening should be reached by 1 January 2015.
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Unbundling

The TSO has accounting and functional unbundling, but not legal or ownership. Legal separation is foreseen at the amendments of the Energy Law. All DSO have less than 100,000 customers. Legislation does not require companies to legally unbundle distribution and supply activities. It is expected that such provision would be introduced through the amendment of the Energy Law in compliance with 2003/55/EC Natural Gas Directive. The activities of DSO and supply are unbundled within the distribution companies in terms of accounting.

Legislation under preparation:

- Amendments of Energy Law – under preparation by the Ministry of Energy and Mining
- Network codes for transmission and distribution - in preparation process (to involve congestion management methodology)

The secondary legislation is mostly completed and nonetheless, the new structure is seen to be mostly compatible with 2003/55/EC Natural Gas Directive.

2.3. Public service obligation

Households with annual consumption greater than 50,000 m³ can acquire eligible status, too. The eligible customers can freely choose their natural gas suppliers. However, up to date only one qualified gas customers applied for eligible customer status.

2.4. Production, import, storage and transit of natural gas

At the moment the only available gas sources in Serbia are:

- Production on local gas fields in Vojvodina
- Import from Russia via Hungary and Ukraine (Beregovo metering station).

Local production

Local production satisfies less than 8% of Serbia need. There is no available data on domestic natural gas reserve and it’s hard to expect that existing production could be significantly increased.

Import

In 2007, import of gas amounted to 92% of the total consumption, almost all of which originates from Russia (Gazprom), while a very small part (less than 1%) is imported from Hungary in order to meet the peak consumption.

The capacity of the interconnection is 12.96 Mcm/day, with maximum contracted capacity being 11 Mcm/day for Serbia (thus about 4 Bcm/y) and 1.5 Mcm/day25 firm
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and 0.35 Mcm/day interruptible reserved for transit to Bosnia and Herzegovina. Capacity utilization was in the range of 52-54% during 2006 and 2007. There are difficulties in using more due to upstream congestion in Ukraine-Hungary border as well as lack of flexibility tools so that capacity usage is much lower in summer, taking also into account the absence of a storage site.

The contract on transit through Hungary is a long term contract, which expires in 2017, but the needed capacity is defined every year. Allowed flexibility is ± 10%. Necessary capacities in winter period are additionally charged. Srbijagas has a long term contract for transit to Bosnia and Herzegovina (1998-2017), but modifications are being made every year. Capacity arrangements currently in place are:

- Contracted capacity = 1.1 x Qyear / 365(366), ship or pay obligations. Qyear should be defined 5 years in advance. Value of Qyear is 2.4 Bcm for 2008, thus contracted capacity is 7.21 Mcm/day.
- Guaranteed capacity (from contracted capacity to 10 Mcm/day), higher price than contracted capacity should be nominated in April for next year on a monthly breakdown
- Additional capacity (from guaranteed capacity to 11 mcm/day) used for peak supply. Sources of gas are Austrian-Hungarian border, UGS in Hungary, production in Hungary. This part corresponds to 0.5 Mcm/day as firm and 0.5 Mcm/day as interruptible capacity. Two contracts with MOL Production were signed to import gas to cover peak demands in last two winter seasons.

Storage

For many years there has been no gas storage facility in Serbia. However, underground gas storage in Banatski Dvor is under construction. The aim of this installation is to hold about 1/3 of annual demand as storage and allow a flat import profile during the year and therefore decrease import and transit costs. Maximum storage capacity is expected to be 800 Mcm.

In terms of the progress of this project, the gas preparation process (capacity of 3.7 Mcm/day) has been finished, the compressor facilities (1.3 Mcm/day) are functioning and initial amount has been injected for cushion gas purpose, whilst the first withdrawal is expected, with a capacity of 1.2 Mcm/day and quantity of about 180 Mcm until now.

In addition, the production line for preparation, drying and dispatch of the stored natural gas into the gas transmission system is under construction (5 Mcm/day planned capacity).

42 km long double gas pipeline Gospodjinci - Banatski Dvor is under construction. After project finalization total capacity of Banatski Dvor withdrawal will be around 5 Mcm/day which is equal to 50% of Serbian daily needs during winter season.

**2.5. Natural gas network capacities**

Natural gas network capacities are presented on the Figure 12.
2.5.1. Transmission network

The gas transmission system comprises a grid of high pressure gas transmission pipelines operating at 16 - 50 bars, with a total length of 2,140 km, laid at a depth of about one meter below ground. Most important data are presented in the Table 6.
Table 6. Description of the Serbian transmission gas network

<table>
<thead>
<tr>
<th>MAIN FEATURES OF THE GAS TRANSMISSION SYSTEM</th>
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<tr>
<td>Capacity</td>
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<tr>
<td>Pressure</td>
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<td>Length</td>
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<tr>
<td>Diameters</td>
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<td>Age</td>
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<td>Compression Station</td>
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<td>Domestic gas</td>
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<th>Outlets</th>
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<td>Main Metering &amp; Regulating Stations</td>
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<tr>
<td>Gate stations</td>
</tr>
</tbody>
</table>

2.5.2. Distribution network

The distribution system of PE Srbijagas comprises a grid of middle pressure gas pipelines operating at 4 to 16 bars, with a total length of about 650 kilometers, and a grid of low pressure gas pipelines operating at 4 bars, with a total length of 3,000 km (Table 7).

Table 7. Description of the Serbian distribution gas network

<table>
<thead>
<tr>
<th>MAIN FEATURES OF THE GAS DISTRIBUTION SYSTEM</th>
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<td>Middle-pressure</td>
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<td>Length</td>
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<td>Low-pressure</td>
</tr>
<tr>
<td>Length</td>
</tr>
<tr>
<td>Age</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inlets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Metering &amp; Regulating Stations</td>
</tr>
<tr>
<td>Domestic gas</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outlets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial consumers</td>
</tr>
<tr>
<td>Households</td>
</tr>
</tbody>
</table>
2.6. Natural gas energy balance

There is considerable seasonal variation in demand, and the swing on Russian contracted imports is used for balancing demand and supply. There is no Take or Pay penalties, only Ship or Pay for transit. 110% is the swing on domestic production. Additional swing is provided through peak supply contracts with MOL in Hungary (Figure 13).

![Supply and Demand](image)

Figure 13 Variations of local production, import and demand

Interruption of 5 major industrial consumers is the second step in periods with peak demands (usually in winter days with temperature below 0°C). Line-pack variation is used mostly for balancing on an hourly level. Volume at operating pressure of line-pack is 240,000 m$^3$/bar. Possibility to increase domestic production is limited to 0.05 Mcm/day. The new storage facilities will obviously greatly improve and add to balancing options.

Natural gas balance for last years is presented in the Table 8 and Figure 14.

<table>
<thead>
<tr>
<th>Table 8 Production, import and delivery of natural gas (10$^6$ m$^3$)</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOMESTIC PRODUCTION</td>
<td>236</td>
<td>193</td>
<td>193</td>
<td>186</td>
</tr>
<tr>
<td>IMPORT (WITH TRANSIT)</td>
<td>2,587</td>
<td>2,635</td>
<td>2,454</td>
<td>2,487</td>
</tr>
<tr>
<td>TRANSIT FOR BIH</td>
<td>323</td>
<td>386</td>
<td>369</td>
<td>319</td>
</tr>
<tr>
<td>CONSUMED IN SERBIA</td>
<td>2,500</td>
<td>2,442</td>
<td>2,278</td>
<td>2,355</td>
</tr>
</tbody>
</table>
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Figure 14. Balance of natural gas in Serbia

Structure of natural gas consumption is presented in the Table and on Figure 15.

Table 9 Structure of natural gas consumption (10^6 m^3)

<table>
<thead>
<tr>
<th>CONSUMPTION</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELECTRICITY PRODUCTION</td>
<td>66</td>
<td>70</td>
<td>44</td>
<td>136</td>
</tr>
<tr>
<td>DISTRICT HEATING</td>
<td>449</td>
<td>428</td>
<td>474</td>
<td>418</td>
</tr>
<tr>
<td>INDUSTRY</td>
<td>1,326</td>
<td>1,301</td>
<td>1,166</td>
<td>1,225</td>
</tr>
<tr>
<td>SCHOOLS AND HEALTH CENTERS</td>
<td>32</td>
<td>34</td>
<td>34</td>
<td>35</td>
</tr>
<tr>
<td>HOUSEHOLDS</td>
<td>348</td>
<td>358</td>
<td>397</td>
<td>381</td>
</tr>
<tr>
<td>FOOD PRODUCTION</td>
<td>154</td>
<td>155</td>
<td>117</td>
<td>115</td>
</tr>
<tr>
<td>PHARMACY</td>
<td>14</td>
<td>14</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>SELF CONSUMPTION AND LOSSES</td>
<td>105</td>
<td>78</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>OTHERS</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>TOTAL</td>
<td>2,500</td>
<td>2,442</td>
<td>2,278</td>
<td>2,355</td>
</tr>
</tbody>
</table>
2.7. Construction of new facilities

In order to provide second direction of natural gas supply and to increase security of supply The Agreement between the Government of the Republic of Serbia and the Government of the Russian Federation on Cooperation in Oil and Gas Sector, has been signed, which part is the realization of South Stream project through Serbia. The South Stream gas pipeline, proposed by Russia’s Gazprom and Italy’s Eni, will run from Russia’s Black Sea coast under the sea to Bulgaria, where it will branch off to northern and southern destinations in the European Union, supplying 30 billion cubic meters of gas annually to Romania, Hungary, the Czech Republic, Italy, Austria and Serbia. Deliveries are to start in 2013. Within the project the Banatski Dvor underground gas storage facility will be expanded from 800 million to 3 billion cubic meters and turn Serbia into a gas distribution hub of southeastern Europe.

During 2006-2008 several projects are financed fro National Investment Plan. Following table summarize developed or projects (GL – gas line, MRS – Metering and Regulation Station).
Table 10. Facilities under construction

<table>
<thead>
<tr>
<th>Facility</th>
<th>Level of completion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 GL i MRS Uzice</td>
<td>100</td>
</tr>
<tr>
<td>2 GL 08-02/2 Batocina – Cvetojevac</td>
<td>90</td>
</tr>
<tr>
<td>3 GL 09-04 Krusevac-Trstenik-Vrnjaska Banja</td>
<td>100</td>
</tr>
<tr>
<td>4 GL 09-04-1 Vrbnica-Aleksandrovac</td>
<td>100</td>
</tr>
<tr>
<td>5 GL 08-17 Paljevsko polje-Kosjeric</td>
<td>60</td>
</tr>
<tr>
<td>6 GL 08-17 Pozega – Arilje</td>
<td>90</td>
</tr>
<tr>
<td>7 GL and MRS Markovac</td>
<td>100</td>
</tr>
<tr>
<td>8 GL and MRS Milosevac</td>
<td>100</td>
</tr>
<tr>
<td>9 GL and MRS Pozega</td>
<td>100</td>
</tr>
<tr>
<td>10 GL 08-19 Uzice – Cajetina- Zlatibor</td>
<td>60</td>
</tr>
<tr>
<td>11 Underground storage Banatski Dvor</td>
<td>50</td>
</tr>
</tbody>
</table>

At the beginning of 2008 new set of projects are initiated by decision of Serbian Government. List of these projects are presented in the following table.

Table 11. List of foreseen projects

<table>
<thead>
<tr>
<th>Facility</th>
<th>Level of completion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Gasification of Kraljevo city</td>
<td>50</td>
</tr>
<tr>
<td>2 MRS and distribution network Triangl – Sabac</td>
<td>10</td>
</tr>
<tr>
<td>3 Gasification of Batocina municipality</td>
<td>10</td>
</tr>
<tr>
<td>4 GL 08-05 Osipaonica–Pozarevac and MRS Pozarevac</td>
<td>10</td>
</tr>
<tr>
<td>5 GL Pozega-Arilje-Golija – second phase</td>
<td>10</td>
</tr>
<tr>
<td>6 GL Zlatibor district</td>
<td>0</td>
</tr>
<tr>
<td>7 GL Kolubarski and Macvanski districts – first phase</td>
<td>0</td>
</tr>
<tr>
<td>8 GL Sumadijski district – first phase</td>
<td>10</td>
</tr>
</tbody>
</table>

Natural gas volume is measured with validated and checked metering devices. At most places metering data are corrected to standard conditions by the metering device itself. Final data from some (a minority) of the metering stations are transferred to central control location by telemetry, which cover about 70% of quantity/year. There is lack of meters in several Main metering and Regulation Stations (MMRS). There is a programme to install meters at those points and the problem is expected to be resolved by 2009. New SCADA system for commercial purposes is expected to be implemented with funds from IPA in 2009. The IT systems are planned to be in place by 2011.
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Historically transmission and distribution were vertically integrated and meters were not installed at the all off-takes and losses have been determined based on quantities estimated by gas transmission and metered quantities at appropriate medium pressure networks. According to estimations by Srbijagas, the losses of natural gas transmission in 2007 amount to 1%. The programme to install meters is in hand and close to being completed. 90% of daily meters will be installed until the end of 2010.

In view of the fact that the energy sector and infrastructure projects cannot be confined to one country boundaries, and that those strategic issues must be planned and implemented in regional and wider terms, PE Srbijagas has made plans to connect its system to the systems of other countries in the region:

- Connection to the Romanian system via the Arad-Mokrin route
- Possible additional connection point with Bosnia and Herzegovina via the Novo Selo-Bijeljina route
- Connection to Bulgarian system via the Niš-Dimitrovgrad route
- Connection with Croatia via the energy corridor at Sotin at the Danube.

2.8. Conclusion

Regulatory framework related to Serbian natural gas sector evolved significantly in last 5 years. Sector that has been typically managed by state companies, has adopted the open-market mechanisms and activities on natural gas distribution are already managed by some private companies.

Previous gas crisis highlight importance of supply security. Activities like signing agreement for South Stream project and agreements with other (backup) suppliers represents some of state institution responds in order to improve security of supply.