



Executive Council of the AP Vojvodina  
**PROVINCIAL SECRETARIAT FOR ENERGY AND MINERAL  
RESOURCES**  
Novi Sad

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**IMPLEMENTATION PROGRAM OF THE  
ENERGY DEVELOPMENT STRATEGY  
OF THE REPUBLIC OF SERBIA IN THE AP VOJVODINA  
(2007 - 2012)**  
***(AMENDMENTS AND SUPPLEMENTS)***

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## INTRODUCTION

Good energy infrastructure assumes quantity, quality, and reliability of supply and required parameters of primary and final energy carriers. The AP Vojvodina does not have sufficient quantities of any of energy carriers. In addition to that, the energy efficiency in all energy sectors is below desired and possible level and the use of available renewable energy sources is completely marginalized. The existing legal regulations are insufficient and not elaborated, energy market and energy services are not developed and energy policy and development strategy are not adequate for present needs of economic development and reduction of energy consumption.

In June 2007, the Executive Council of the Autonomous Province of Vojvodina adopted the "Implementation Program of the Energy Development Strategy of the Republic of Serbia in the AP Vojvodina (from 2007 to 2012)" which is complied with the Law on Energy of the Republic of Serbia. This law has anticipated an obligation to analyze every two years implementation of the adopted Program and make necessary amendments and supplements. Following this obligation and also taking into considerations real needs to harmonize activities in the area of energy in the AP Vojvodina to very dynamic economic and social flows, we have started to prepare this document.

From the time when the first version of the Program was completed until today, significant changes in conditions and circumstances have occurred relevant to the overall economic environment in Serbia and wider. Current global economic recession, which is also present in our country, will certainly last for several years and this requires the adjustment of this Program. However, when energy is concerned, there are no doubts that it will be necessary to intensify the existing Program even more in respect of increasing energy efficiency and utilizing renewable energy sources. In addition to that, the construction of new conventional energy capacities with high efficiency is an investment with the least risk and this can mean continuation of investment activities in the area of capital energy.

When the use of nuclear energy in plants for the production of electrical energy is concerned, we are of the opinion that such projects should be taken into consideration on equal terms with all other projects. In so doing, two facts should be borne in mind: implementation of programs for building nuclear power plants lasts for a long time which exceeds the timeline of this Program, and such programs should include carefully elaborated part concerning nuclear wastes disposal.

Provincial Secretariat for Energy and Mineral Resources prepared **Amendments and Supplements** of the Implementation Program of the Energy Development Strategy of the Republic of Serbia in the AP Vojvodina (until 2012) which was adopted at the 77. session of the Executive Council of the Autonomous Province of Vojvodina held on 9. September 2009. This Document is prepared on the basis of the Article 6 of the Law on Energy (the Official Herald of the Republic of Serbia, Number 84-2004). The Implementation Program of the Energy Development Strategy of the Autonomous Province of Vojvodina with conclusions of the Executive Council of the Autonomous Province of Vojvodina is forwarded to the Government of the Republic of Serbia and to the Ministry of Mining and Energy.

This Document governs basic objectives and priorities in the development of energy in the Province, as well as measures and activities for their implementation in the period until 2012 which meets the requirements for the implementation of the Energy Development Strategy at the territory of the AP Vojvodina. In addition to that, it gives the potentials of the AP Vojvodina in the energy field, proposals of priorities for the Program aimed at improving all energy sectors and the assessment of necessary investments. However, the most important thing is to harmonize activities with other secretariats of the Executive Council in the implementation of this Program. Only institutions are capable of launching such a Program and this is why they are expected to provide strong support in its implementation. This Document also provides an overview of current activities in all energy sectors

which are neither negligible in relation to investments nor in relation to volume, as well as guidelines and corrections of previously laid down plans. Discussions about nuclear energy are not taken into account in this Document. Possible changes of the Energy Development Strategy of the Republic of Serbia will provide conditions for such an analysis as well.

The Provincial Secretariat for Energy and Mineral Resources has authorized the Faculty of Technical Sciences from Novi Sad to prepare this Document. The list of experts from the Faculty and outside who have taken part in the preparation of this Document is given in the enclosure at the end of the text. The Provincial Secretary for Energy and Mineral Raw Material has appointed Tomislav Papić, Deputy Provincial Secretary as the project leader. The Faculty from its side has designated its organizational unit, the Provincial Energy Efficiency Center, to be in charge of the committed task.

The Provincial Secretary for Energy and Mineral Raw Material, Radoslav Striković, dipl. ecc., provided basic guidelines for the preparation of the text and its finalization is carried out by prof. dr Dušan Gvozdenc, doc. dr Jovan Petrović and prof. dr Ljubomir Gerić.

The task of experts was to propose amendments and supplements for the whole text of the IMPLEMENTATION PROGRAM OF THE ENERGY DEVELOPMENT STRATEGY OF THE REPUBLIC OF SERBIA IN THE AP VOJVODINA (from 2007 to 2012), (June 2007). In addition to that, the experts were asked to provide an overview in the field of their expertise, propose improvements in the relevant field and an action plan for the program implementation.

The professional unit of the Provincial Secretariat for Energy and Mineral Resources also provided their vision of the valid program application and gave proposals for its improvement.

I take this opportunity to thank all participants in this task who have contributed with their personal commitments and work in rendering this important document.

Novi Sad,  
September 2009

Provincial Secretary for Energy  
and Mineral Resources

Radoslav Striković, dipl. ecc.

## SUMMARY

There are four essential strategic directions of energy development in the AP Vojvodina in the period until 2012:

1. Building and reconstruction of energy facilities with larger powers for the production of electrical and heat energy,
2. Increase of crude oil and natural gas production by means of concessions in the country and abroad,
3. Increase of energy efficiency in all energy sectors,
4. Significant growth in using renewable and combined energy sources.

The proposed sequence is not also the sequence of priorities. The choice of priorities will mostly depend on the political willpower and readiness of competent institutions to get on with their implementation. The implementation of proposed strategic trends will provide conditions for:

1. Technological modernization of energy systems and increase of their energy efficiency,
2. Reduction of primary energy consumption at the level of the country
3. Reduction of harmful emissions,
4. Rising competitiveness of our economy in the international distribution of work

For the implementation of the proposed Program, substantial funds are needed which can be raised as follows:

1. Giving concessions,
2. Establishment of Funds,
3. Co-financing from international projects aimed at the reduction of harmful emissions,
4. Private investments.

Since all technical conditions for the implementation of proposed measures exist, there is a need to intensify provision of non-technical conditions which imply:

1. Clear and unreserved political support articulated in the energy policy,
2. Development of energy and energy carriers markets,
3. Development of institutions which have to carry out and monitor execution of individual projects,
4. Application and development of new energy technologies and services in the field of energy,
5. Defining and enabling stimulating measures,
6. Organizing education of all layers of society relevant to the importance and potentials of increased energy efficiency and renewable energy sources.

Tasks defined in the above manner require commitment from the side of all political factors and professional institutions in corresponding domains because only simultaneous and well coordinated long term action can produce expected and tangible results.



## **1. ENERGY DEVELOPMENT STRATEGY OF THE REPUBLIC OF SERBIA AND IMPLEMENTATION PROGRAM IN THE AP VOJVODINA<sup>1</sup> (2007 - 2012)**

§1. The Energy Development Strategy of the AP Vojvodina and realization of the Strategy Implementation Program should contribute to the improvement of energy sectors in the AP Vojvodina through: implementation of the new energy policy, priority development in all energy sectors in compliance with the Strategy, increased safety and reliability of supply of energy carriers and energy to all categories of consumers of energy carriers and users of energy, improvement of business operations and long term planned development of all energy sectors and contribution to environment preservation.

§2. In compliance with the Article 6 of the Law on Energy of the Republic of Serbia, the Strategy Implementation Program is passed by competent authority of the AP Vojvodina and it makes an integral part of the Implementation Program of the Energy Development Strategy of the Republic of Serbia. Although this law does not anticipate the preparation of the Energy Development Strategy of the AP Vojvodina, it does not prevent the existence of such a document if it is in line with the current Energy Development Strategy of the Republic of Serbia. This document is certainly complied with the Strategy.

§3. Implementation Program of the Energy Development Strategy of the Republic of Serbia includes the following sectors: oil, natural gas, coal, electrical energy sources, transmission and distribution of electrical energy, thermal power and heating plants, industrial energy, energy efficiency, renewable energy sources, the Energy Efficiency Fund and environment protection.

§4. Sectors are elaborated through modules in line with the division which is made by the Ministry of Mining and Energy of the Republic of Serbia. In this aggregate document, certain sectors are treated to the extent of their presence in the AP Vojvodina (APV) and according to realistic potentials for implementation in the planned period until 2012.

## **2. BASIC CHARACTERISTICS OF ENERGY SYSTEMS IN THE WESTERN BALKANS**

§5. The energy system of the AP Vojvodina as part of the energy system of the Republic of Serbia should be observed as the part of the energy system of the Western Balkans. The Western Balkans is comprised of the following regions: Albania, Bosnia and Herzegovina, Croatia, Former Yugoslav Republic of Macedonia, Montenegro, Serbia and Kosovo (under the UN Administration). Basic economic parameters of these regions are shown in the Table 2.1. Relatively high growth rate of the GDP (except Kosovo) used to be their basic characteristics. Today, due to the global recession, this rate is significantly lowered.

The need for such wider considerations of energy sectors in the AP Vojvodina can be found in the fact that energy systems in the regions of the Western Balkans are similar in technological respects and they are all relatively small. In addition, their energy indicators are similar and usually unfavorable. All this indicates the need to plan development of each individual system with simultaneous consideration of requirements of the whole energy system of the Western Balkans.

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<sup>1</sup> The Autonomous Province of Vojvodina covers the area of 21,506 km<sup>2</sup>. It consists of 44 municipal self governments and the City of Novi Sad with the total population of 2,031,992 (data from 2003).

Table 2.1: basic Economic Parameters of Western Balkans Regions (200)

	Population [million]	GDP billion US\$ (ppp 2000)	GDP (ppp)* billion US\$ (ppp 2000)	GDP (ppp) per capita [US\$]	GDP Growth Rate [%]	Unemployed
Albania	3,13	4,79	14,80	4 700	4,5	13
Bosnia and Herzegovina	3,91	6,44	25,80	6 600	5,0	40
Croatia	4,44	23,16	51,55	11 600	4,3	13
FYR Macedonia	2,03	3,84	13,03	6 400	3,6	37
Montenegro	0,63	2,10	3,80	6 000	8,0	28
Serbia	7,40	8,77	40,50	5 500	5,5	20
Kosovo (UN)	2,40	2,00	4,80	1 600	-1,0	40
<b>TOTAL</b>	<b>23,90</b>	<b>51,10</b>	<b>154,28</b>	-	-	-

\* ppp Local currency value evaluated on the basis of the purchasing power for goods and services in relation to, in our case, US\$ in 2000.

§6. Energy Parameters of Western Balkans Regions are shown in the Table 2.2.

Table 2.2: Basic Energy Data for Western Balkans Regions (2005) (mtoe)

	Total Primary Energy Consumption (TPES)	Domestic Production	Imports	Exports	Net Imports	Import Dependence*	Total Final Consumption	Energy Intensity [toe/1000US\$(ppp)]
Albania	2,4	1,2	1,2	0,0	1,2	51	2,1	0,16
Bosnia and Herzegovina	5,0	3,3	1,9	0,3	1,6	32	3,0	0,19
Croatia	8,9	3,8	7,8	2,6	5,2	58	7,1	0,17
FYR Macedonia	2,7	1,5	1,6	0,3	1,2	45	1,7	0,21
Montenegro	1,0	0,6	0,5	0,1	0,4	40	0,8	0,26
Serbia	16,7	11,4	6,4	1,1	5,3	32	9,7	0,41
Kosovo (UN)	2,0	1,2	0,9	0,1	0,8	40	1,0	0,42
<b>TOTAL</b>	<b>38,7</b>	<b>23,0</b>	<i>These columns are not added up in order to avoid double calculations due to inter-regional trade.</i>				<b>25,4</b>	

\* Import dependence is calculated as a relation between net imports according to total consumption of primary energy

The structure of energy carriers for the production of electricity in the Western Balkans regions is shown in the Figure 2.1. There is pronounced domination of coal and hydro power and very low participation of natural gas and heavy oil. It is noticeable that there are no renewable sources in the production of electricity which should definitely be introduced. Although nuclear energy is not used, it has been discussed more recently as a realistic alternative for generating electricity. The remaining own hydro potentials and coal potentials cannot be taken as sufficient for a certain longer period of time.

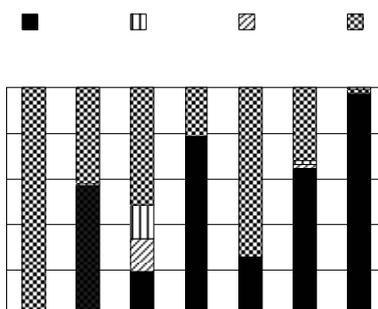


Figure 2.1: Structure of Electrical Energy Production per Fuels (2005)

§7. Basic characteristics of the regions in the Western Balkans can be summarized in the following way:

- Energy infrastructure (primarily thermal power plants) was built in the 1960s and 1970s. Although standards of those times were used, technologies are completely obsolete nowadays. The efficiency of these systems is very low and the risk of technical failures is very high. Very old energy systems, obsolete technologies and poor maintenance require urgent rehabilitation and replacement of this energy infrastructure. The replacement of old plants by new technologically modern ones is still very slow.
- The energy market of the regions in the Western Balkans is very dependent on hydrocarbon fuels which are imported. The common energy infrastructure creates the need for exchange between regions (for example, there are daily and seasonal exchanges of electric power among regions and Serbian refineries are supplied by crude oil through Croatian pipelines, etc.).
- There are great differences among regions regarding total consumption of primary energy, quantities from domestic production, dependent on imports, various structures in the way of electric power production (energy mix) (Table 2.2).
- The sources of crude oil and natural gas are very limited and mostly located in Albania, Croatia and Serbia. Montenegro has small potentials of crude oil and natural gas at the sea. Today, only Serbia (primarily Vojvodina) and Croatia have more significant consumption of natural gas. The markets of Bosnia and Herzegovina and FYR Macedonia are very small, while other regions do not use natural gas at all.
- Coal (mostly lignite) is a dominant source of primary energy in the regions of the Western Balkans. Overall consumption of primary energy was 38% in 2005. The coal is followed by oil (37%) (which has abruptly grown since 2001), then by natural gas (13%), hydropower (7%) and other renewable sources of energy with 5%. In 2005, the total consumption of primary energy reached the figure of almost 90% of its consumption in 1990.
- Until 1992, the electric power grid of the former Yugoslavia was connected to the Union for the Co-ordination of Transmission of Electricity – UCTE, i.e., Western European grid. The energy infrastructure in Serbia, Kosovo and Bosnia and Herzegovina, which was poorly maintained during the nineties, was significantly damaged during the war in the nineties. In 1992, the grid was separated. On the west, Croatia and southern and western part of Bosnia and Herzegovina remained within the system UCTE in the zone 1. The remaining parts of Bosnia and Herzegovina, Serbia and FYR Macedonia, together with Bulgaria, Romania and Greece comprise the southeast UCTE zone 2. From the early 2000s, the transmission systems operators in the region have to a great extent rehabilitated national grids and interconnections. This was of great help and in 2004, the connection between grids of UCTE zones 1 and 2 was established again and they were re-synchronized with UCTE. This has improved safety of electricity supply, supply varieties, export opportunities and trading in the region and outside.
- The oil refineries in the regions of the Western Balkans lack adequate maintenance and investments in the modernization of equipment. Today, only 40% of available refinery capacities are used.

### **3. CONDITIONS OF ENERGY SECTORS IN THE AP VOJVODINA**

§8. Basic characteristics of the situation found in almost all energy sectors in the APV is a setback in progress at the beginning of the nineties of the last century, stagnation and technical and technological falling behind in comparison to other European countries, deterioration of reached levels in technical, regulatory, personnel and all other aspects and present raised overall social awareness that recovery is crucial. Further development of energy sectors and acceptably fast European integrations are almost impossible without exceptional efforts with comprehensive effects inn the development of this region.

The new conditions defined by changed ownership in the oil and natural gas sector require the revision of the Strategy and the Program for this sector. It is very likely that in the period until 2012, the same or similar changes will occur in other energy sectors.

It is, however, necessary to emphasize that there is a positive trend in the energy development in the AP Vojvodina and Serbia which is reflected in the completion of many overhauls and general overhauls of plants and preparation of investment projects whose realization or even the beginning of realization can be expected in the period until 2012.

### 3.1 Basic Energy Balance Indicators

§9. Totally generated production and total consumption of energy carriers and energy at the territory of the AP Vojvodina according to the “Energy Balance of the Autonomous Province of Vojvodina – Plan for 2009” are given in the Figure 3.1 a) and b). Total **production of primary energy** in the AP Vojvodina amounted to 0,963 mtoe in 2008 (around 11,2 TWh). It is obvious that oil is dominant with the share of 64%. It is followed by natural gas with 21% and coal with 7% and there are 8% of renewable energy sources. The production of electrical energy from hydropower does not exist in Vojvodina. The appearance of renewable energy sources in the energy balance is certainly a positive shift in relation to the document which was published in 2007. The reason is putting into operations industrial boilers on biomass. Unfortunately, although the biodiesel factory has been built, it is not used for the production of biodiesel but for the production of crude edible oil. The reason for that is the lack of adequate regulations and stimulating tariff system.

Total **primary energy consumption** in the AP Vojvodina is 4,01 mtoe. If electrical energy taken over from the EPS (Electricity Industry of Serbia) is converted into primary energy with the transformation coefficient 0,39, then total primary energy consumption in the AP Vojvodina amounts to **5,16 mtoe** for 2008 (around 60 TWh/a).

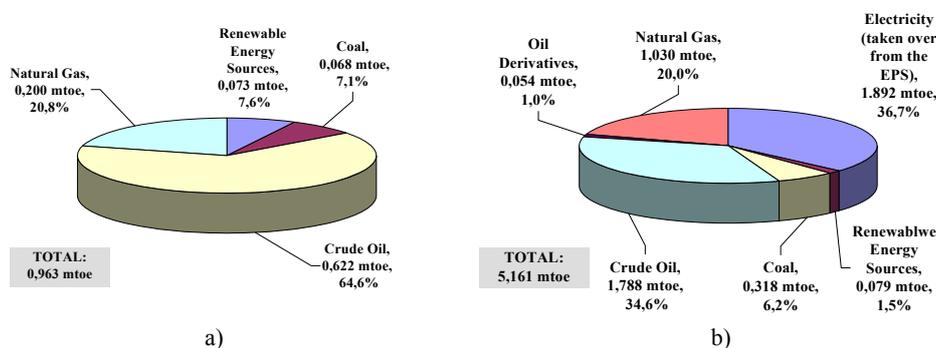


Figure 3.1: Primary Energy Balance for 2008  
a) Total Production at the Territory of the AP Vojvodina, b) Total Consumption at the Territory of the AP Vojvodina

§10. The consumption of the total energy stated in the primary form at the territory of the APV indicates the domination of electrical energy with 36,7%, it is followed by oil and oil derivatives with 35,6% and natural gas with 20,0%, while the share of coal is 6,2% and non-conventional sources are only 1,5%.

§11. Import dependence and supply for the AP Vojvodina (stated in primary energy) amounts to: for electrical energy 94,1% (remaining electrical energy is generated from fossil fuels in energy transformations at the territory of the APV), followed by gas with 80,6%, then coal with 78,6% and oil with 65,2%.

§12. Illustration of elements of final energy balance in the AP Vojvodina is given in the Figure 3.2. The Figure 3.3 shows final energy consumption per sectors (industry; transport and other – households, public communal enterprises and agriculture).

The Table 3.1 shows the portion of final energy consumption for energy purposes per industrial sectors for Serbia, some neighboring countries and the world. The percentage of final energy consumption in industry in relation to households, public communal enterprises and agriculture is satisfactory in Serbia.

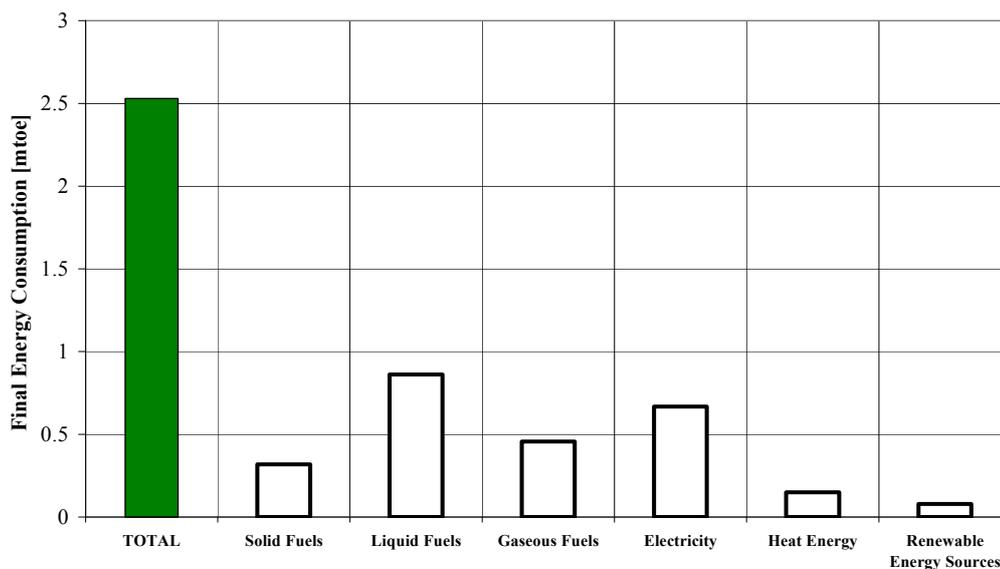


Figure 3.2: Final Energy Balance per Fuels/Energies – 2008

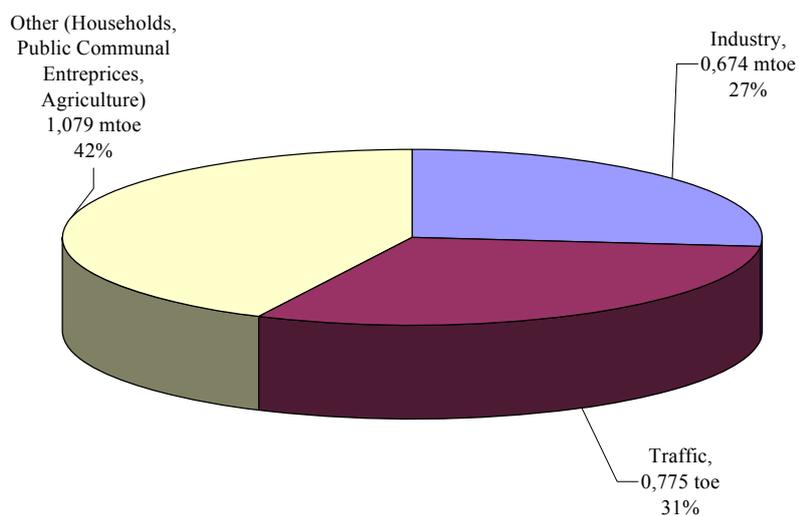


Figure 3.3: Share of Final Energy Consumption per Sectors in the AP Vojvodina (2008)

*Table 3.1: Share of Final Energy Consumption in Overall Primary Energy Consumption per Sectors (2006)*

	Serbia	Bulgaria	Croatia	Albania	Bosnia and Herzegovina	Macedonia	EU 27	WORLD
Industry	33,7%	32,6%	22,9%	14,2%	20,6%	33,8%	24,1%	27,0%
Transport	23,7%	27,4%	28,5%	39,3%	29,6%	20,5%	28,9%	27,5%
Other	37,5%	31,0%	38,9%	38,2%	46,4%	44,0%	38,4%	36,3%

The Table 3.2 provides electrical energy consumption in the AP Vojvodina for 2008. It is important to notice that average power is 1650,9 MW. In addition to that, it is necessary to say that electricity distribution losses are 12,6%, which is very unfavorable and represents one of the largest losses in Europe.

Total installed power of the system for the production of electrical energy in Serbia (without Kosovo) is 7120 MW (2831 MW hydro, 3936 MW lignite fired thermal energy plants, 353 MW thermal power plants – heating plants fired by natural gas or heavy oil and coal). Total gross production was, for example, in 2007, 39 TWh/a and in 2008, 35 TWh/a. The electrical energy system of Serbia is connected with the systems of neighboring countries with a carrying capacity of around 1000 MW in the directions north – south and east – west. The peak power of the system in Serbia without Kosovo was around 6595 MW in 2008. The load factor amounts to around 56%. The import of electrical energy is particularly intensive in winter months.

The consumption of electrical energy per capita is the one of the highest in the region, which indicates very low efficiency and unjustifiable and inadmissible use of electrical energy for heating of flats.

*Table 3.2: Total Consumption of Electrical Energy in the AP Vojvodina (2008)*

Households	High and Medium Voltage	Other	Totally Supplied	Electricity Distribution Losses	From Transmission	POWER
GWh/a	GWh/a	GWh/a	GWh/a	GWh/a	GWh/a	MW
3977,9	2432,0	1424,6	7834,5	1131,4	8965,9	1650,9

For the overall planned period, it is anticipated to have the growth of electricity consumption by 5% (on the average 1,3% per year). Thus, at the threshold of the transmission system in 2012, it is planned to have consumption of 9422 GWh/a. It is also planned to have stagnation in consumption in 2009 and 2010 particularly if the price of electrical energy is going to be increased.

§13. The Figure 3.4 shows the efficiency of primary energy transformation (it is defined as the ratio between total final energy consumption and total primary energy consumption – non-energy consumption is deduced). Exceptionally high figures for Croatia and Albania are the consequences of large imports of electrical energy in Croatia and high proportion of hydropower in Albania.

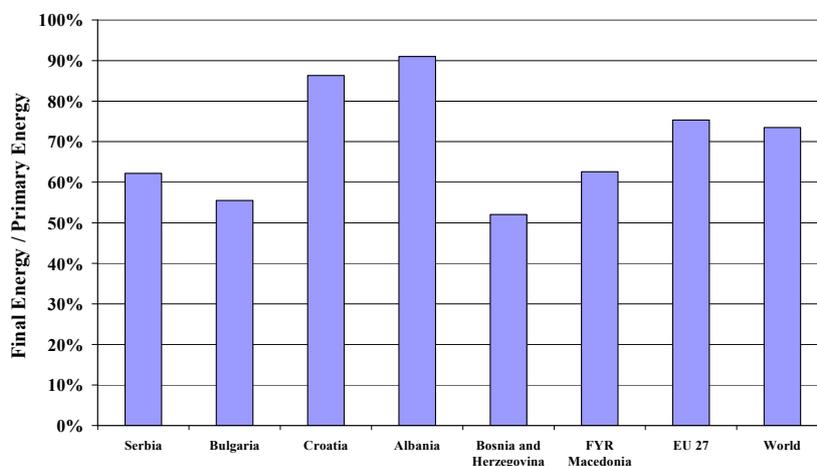


Figure 3.4: Efficiency of Primary Energy Transformation (2006) [60]

By comparing efficiency of transformation in Serbia with the average in EU 27 (which is targeted figure), it can be concluded that Serbia still lags behind and that it is yet another proof of low energy efficiency in general.

The production of natural gas in Serbia fulfils around 15% of annual demand. The Table 3.3 shows gas sources, domestic and foreign with average bottom heat value in the course of 2007 and 2008.

Table 3.3: Structure of Natural Gas Sources in 2007 and 2008

Gas pipeline system of the Public Enterprise "Srbijagas" Gas	Million m <sup>3</sup> (2007)	Million m <sup>3</sup> (2008)	Average Bottom Heat Value
Domestic gas (NIS-Naftagas) (Deliver to the pipeline)	214,7 (16,6 %)	211,4 (14,4 %)	Around 30000 kJ/m <sup>3</sup>
Imported gas totally transferred	1073,85 (83,3 %)	1253,12 (85,6 %)	Around 34000 kJ/m <sup>3</sup>

### 3.2 Production Possibilities

§14. The present production of relatively high quality lignite is carried out at the special underwater mine in Kovin with around 250 000 t/a (~65,70 ktoe/a). Although it is expected that there will be reduced demand with current consumers of this coal, it is possible that there will be significantly accelerated exploitation (for exports or consumption in electrical power plants). This is allowed by so far established and in particular, by evaluated reserves.

§15. The production of crude oil at domestic terrains (650 000 t, in 2005) is gradually lessening and these trends will be continued in spite of some new technologies for increasing exploitation degree of existing drills and possible new ones. However, there are realistic possibilities for a significantly larger engagement at the international research and production projects under concession contracts at prospective terrains and by deploying new technologies which are aimed at complete exhaustion of drills. The internal program of the NIS (the Oil Industry of Serbia) accounts for the production of almost 1 800 000 t/a in 2015 by deploying this idea. This program will be innovated with the majority owner "GASPROM-NEFT".

The domestic production of natural gas has been stagnant for several years at around 200.000.000 m<sup>3</sup>/a, although internal plans of the NIS anticipate significant growth in the course of 2008 at around 333.000.000 m<sup>3</sup>/a (not reached) and reaching the figure of around 495.000.000 m<sup>3</sup>/a in 2015. This plan will be revised by the new majority owner "GASPROM-NEFT". However, no

matter whether these plans are realistic or not, the consumption of natural gas will be relied on imports.

**§16.** In case of new and renewable energy sources, the greatest resource concerns wastes generated by farming and forestry. According to existing already prepared studies and available data which are kept by the Provincial Secretariat for Energy and Mineral Resources, the energy potential varies around 20.500 TJ/a (~0,50 mtoe/a) which represents about 11% of the Vojvodina's needs reduced to the primary form of energy. For the time being, there is no organized utilization of these resources to the sufficient extent.

Realistically possible organized production of biogas at large animal farms is around 7 million m<sup>3</sup>/a (around 160 TJ/a ~ 0,004 mtoe/a). Although it is a negligible source, it is very important ecologically and for organic production of fertilizers. There are no estimates of possibilities for the production of this energy carrier from wastewaters of municipal sewerage systems and food processing industry where considerably larger quantities can be expected. Primary energy of municipal, medical and industrial wastes in Vojvodina has been rather reliably estimated to around 6,65 TJ/a ~ 160 ktOE/a, and although energetically completely marginal, it is ecologically very important.

There are precisely defined resources in geothermal power of around 85 MW<sub>e</sub>, i.e., 750 GWh/a. Presently, less than 15 GWh/a is used which is around 2% of one year's existing possibilities. The main reason for poor utilization concerns inadequate consumers.

At the very beginning is the wind power exploitation (today's estimates suggest production of around 450 GWh/a from 2011 or around 5% of the today's consumption of electrical energy). Based on realistic possibilities of the electrical energy system of Serbia to provide balance energy in order to support this type of power plants, it is estimated that there are possibilities for installing around 250 MW of these power plants at this moment.

Also, discussions related to the construction and utilization of small hydropower plants have only just started and the first estimates indicate that in Vojvodina, it is at the level of around 90 GWh/a (around 1% of present electrical energy consumption).

In Vojvodina at this moment, it is very likely that the most promising renewable energy source is the production of biodiesel and ethanol. The biodiesel factory has been completed in Šid with the capacity of 100 000 t/a. The profitability of this production may lead to the much more cost effective use of land and its large scale cultivation. The shift of the factory in Šid to the production of edible oil instead of biodiesel indicates the lack of adequate regulations.

**§17.** The solar energy is not used at all except sporadically for individual needs. With reference to the level of radiation, the AP Vojvodina has potentials larger than Germany where there are 3.9 GW in photovoltaic (FN) panels currently installed for the production of electrical energy. The high price of equipment and installation and small unit power make energy from these sources still much more expensive higher than even European price of electrical energy and therefore, without substantial stimulations from the Government, these sources are not very likely to be used. The problem concerns large surface which should be taken (covered) for the installation of FN panels and there are realistic opportunities for their placement on roofs or other surfaces of buildings in towns and settlements. The potentials of solar radiation vary on the average around 5,5 kWh/m<sup>2</sup>/day with large annual variations (1,6 kWh/m<sup>2</sup>/day – 8 kWh/m<sup>2</sup>/day). The conversion into electrical energy in FN panels may generate around 1130 kWh/a from 1 kW<sub>p</sub> FN panels which require occupying around 6 m<sup>2</sup> (in Germany under the same conditions, 935 kWh/a are generated). For covering annual consumption of one household in the AP Vojvodina, it is necessary to have around 5-6 kW<sub>p</sub> FN panela (or 30-35 m<sup>2</sup> roofs) [72], thus the potentials can be estimated to around 565 GWh/a (if only 10% of households build in FN panels). This is substantial potential (6,8% of the today's consumption of electrical energy) and conditions should be created for its deployment.

**§18.** Vojvodina has 3 thermal power – heating plants (TE-TO) with total nominal electric power of 405,50 MW and total heat power of around 500 MW. If the available capacities were used around 6000 h/a (electrical) and 4000 h/a (heat) would transform one part of expensive primary energy (around 0,60 mtoe/a). However, due to high production costs of electrical energy in these power plants, the capacities are mostly used for peak production (356,45 in 2005 and 138,50 GWh<sub>e</sub>/a in

2006), which is less than 15% of technical possibilities with above mentioned higher exploitation of available capacities.

§19. In many thermal power plants and in larger boiler houses, part of primary energy (natural gas, heavy oil and fuel oil around 0.1450 mtoe) is transformed into heat energy, and out of totally produced heat energy 93% are used for large scale consumption.

§20. Former investigations have shown that there are opportunities for using hydropower potentials of the Danube (Hydropower Plant (HE) Novi Sad, with the power of 130 – 210 MW, and average annual consumption of 985 – 1500 GWh) and of the Sava ( HP Obrež, with the power of 70 MW, and average annual consumption of 440 GWh).

### 3.3 Technical and Technological Basis

§21. Present technical conditions in 3 cogeneration plants in the AP Vojvodina are presented in the Table 3.4.

Table 3.4: Basic Indicators of Conditions in Cogeneration Plants PD “Panonske TE-TO” (“Panonian Thermal Power – District Heating Plants”)

Thermal Power Plant – District Heating Plant	Number			Power $MW_e - MW_t$ - t/h	Starting Year	Nominal Service Life [h]	Utilized until 31.12.2005	Average Efficiency until 2005
	Blocks	Boilers	Turbo Generators					
TE-TO NS	2	3	2	245-332-320	1981/84	200 000	30,4%	~ 59%
TE-TO ZR	1	2	1	120-140-310	1989	200 000	8,1%	~ 48%
TE-TO SM	1	4	1	32- 40- 200	1979	200 000	56,0%(1)	~ 58%(2)

Note: (1) Only turbo generator; (2) Efficiency of electric power generation ~ 21.3%

§22. Taking into consideration the fuel (natural gas and heavy oil) all 3 plants are conceptually obsolete. On these grounds, it will be necessary to combine steam-gas plants with the primary function of electrical energy production with high electrical efficiency exceeding 55%. This change is imposed by very uneven demand for technological steam and particularly drastically varying demand for heating. Otherwise, mainly due to the prices of electrical and heat energy, these facilities will become practically out of use, and the option of their privatization should be seriously taken into considerations. However, technical condition and availability of plants are still at a fairly good level (and on these grounds they are engaged within the EPS system).

§23. In 17 thermal power plants (+3 as peak capacities connected with TE-TO) there are around 50 hot water and several steam boilers in Vojvodina with the total capacity for heating of 956 MW and over 60 MW for hot sanitary water. In addition to that, there is a capacity of over 150 MW of heat power in a large number of hot water boilers (over 80 units). Technical conditions of boiler plants can be appraised in two ways: a) large plants are mainly in satisfactory or good condition and their smaller part is worn out; b) smaller plants and particularly hot water boilers are mostly worn out and must be replaced or the system of heating should be completely changed.

§24. District Heating Plants in Zrenjanin and Sremska Mitrovica have started to prepare necessary investment-technical documentation for the construction of their own production capacities as heat energy which they have so far purchased from the public enterprise "Panonian Power Plants" is very expensive for their conditions. The estimated overall investment is 4,50 million € (2×35 MW – Zrenjanin and 1×35 MW – Mitrovica). The fact is that there is no cooperation and agreement at the relation district heating plants and "Panonian Power Plants". The changed concept of supplying these cities with heat energy should be coordinated with the Electricity Industry of Serbia (EPS), public enterprise “Panonian Power Plants”, local self governance and local heat energy distributors.

§25. In 132 factories in Vojvodina there are 312 boilers, mostly steam ones. On the basis of the available sample consisting of 36 (11.5%) boilers, average technical data are obtained: heat power 19,5 t/h ~ 13,2 MW, age 29 years, unusable ~ 25% boilers, in use 234 boilers (75%) with unknown synchronization and percentage of used capacities. To the number of 234 boilers, it is necessary to add up 19 boilers (150 MW) in 8 health institutions.

§26. In eight municipal district heating plants in Vojvodina, initiatives are launched to install combined burners fired by heavy oil and gas and to construct tanks. This investment is estimated to

6,50 million €. It seems that that the problem of safe natural gas supply of those district heating plants which use this fuel has become more easily resolved ever since the gas storage has been completed..

§27. For quite some time, activities related to the construction of a source of electrical and heat energy (combined steam – gas plant) important for the AP Vojvodina have been started and stopped several times without any results. Such a plant should be given the highest priority. The preparation of tender procedure (the EPS and the City of Novi Sad) is underway for the selection of a strategic partner of a new gas-steam plant with electrical power of 480 MW and heat power of 300 MW in the TE-TO Novi Sad.

### **3.4 Economic and Financial Potentials and Human Resources**

§28. The successful realization of the Strategy Implementation Program is conditioned by proper and directional utilization of available financial potentials on which it is necessary to insist. The construction of capital investment objects requires utilization of the National Investment Fund, international investment institutions and inclusion of concession arrangements. The improvement of technological and operational performances of energy facilities should be mostly relied on own funding sources. For increasing energy efficiency and utilization of renewable energy sources, it will be necessary to ensure initial, stimulating funds from the government's sources of revenues through special funds including other domestic and international earmarked funds, loans and own funds of beneficiaries.

There are many workers and experts in existing plants in the energy sector who are solidly trained for running the existing plants. But, since all plans are based on the introduction of new and modern technologies, it will be necessary to innovate knowledge of all expert at all levels.

Curriculum for high education have been launched in the area of energy management, energy efficiency and renewable energy sources. They will ensure human resources capable of improving and applying measures envisaged in the energy policy.

A significant number of energy efficiency projects and renewable energy sources in the public and private sectors have been implemented with the assistance of the Provincial Secretariat for Energy and Mineral Resources. Some of projects in the energy field have been launched and many have been implemented by means of proceeds of the Provincial Fund for Capital Investments.

### **3.5 Section Three Conclusions**

§29. By comparing present energy balance indicators and indicators from two years ago, it can be said that there are no large deviations. It is obvious that the proportion of renewable energy sources in the energy balance has been changed. The reason is the completion of plants which use biomass.

It is important to indicate that privatization of the Oil Industry of Serbia (NIS) has recently been performed and that the construction of the gas pipeline South Flow partially passing through the AP Vojvodina has been announced. Also, discussions have been renewed related to possibilities, needs and potential sites of nuclear power plants.

The energy sector in Serbia is undoubtedly one of the most important segments of the economy as it participates with as much as 25% in the gross domestic product of the country.

## **4. ECONOMIC DEVELOPMENT OF THE AP VOJVODINA**

§30. The economy of the AP Vojvodina has a great chance and by means of the realization of the Energy Strategy Implementation Program, its development can be directed towards the new approach to production based on knowledge, high technological solutions, information-communication inputs, infrastructure and services. In all this, the role of the State, and therefore, Provincial authorities, is very important. The authorities should establish efficient legal and regulatory environment and after that withdraw from direct interventions in the economy thus making equilibrium between market institutions and interventions for the purpose of accomplishing development objectives.

§31. Realization of the energy development priorities until 2012 leads not only to the stability in the energy sphere but also contributes to the establishment of overall stability and sustainable and stable economic development. This also requires the following conditions: restructuring energy system, reforming energy market, attracting free investment capital into the energy sphere and providing long term regulatory guarantees for the implementation of expected benefits. This will also improve key macro-economic indicators and primarily growth of employment, investments and services and also entrepreneurs' initiatives.

§32. Accession to the European Union is a strategic goal and therefore targeting factor of the economic development of Vojvodina. The proposed priorities in the energy development of Vojvodina until 2012 are in all their segments in line with well established development directions and EU interventions and therefore, their implementation and conformity to fundamentals of Economic Development of Vojvodina represent also an additional impulse to the realization of this objective.

## **5. ENERGY DEVELOPMENT PRIORITIES UNTIL 2012**

§33. The Strategy defines five basic priorities in the energy development. The first realization period through the Energy Development Strategy Implementation Program at the Territory of the AP Vojvodina until 2012 encompasses the activities within: improvement of technological and operational performances of energy facilities, increase of energy efficiency and the establishment of the Energy Efficiency Fund, utilization of renewable energy sources and the construction of new and capital intensive energy capacities.

### **5.1 Improvement of Technological and Operational Performances of Energy Facilities**

§34. In the gas pipeline system of the AP Vojvodina, the following problems are particularly present: age of the gas pipeline system, inadequate and insufficient maintenance of the system as a consequence of political and economic circumstances after nineties of the last century and instability of the gas pipeline operations under variable pressures.

§35. The reason for insufficient utilization of existing production capacities for cogeneration in Vojvodina are unrealistic parity of energy prices taking into consideration parameters of modern plants, unsatisfactory energy efficiency of thermal power plants.

When we talk about parity of prices, i.e., the price of electricity and natural gas, most frequently used in meeting heating demand in Vojvodina from 2001 to 2006, varied in the range from 1:1 to 1,6:1 which is far the lowest in relation to other European countries in which this relation is starting from 3,5:1 and higher. At the same time, the price of energy from coal, which is used in thermal power plants, is 7-9 times lower than the price of energy from natural gas and heavy oil. Since the facilities of Panonian Power Plants use natural gas or heavy oil under conditions of such parity of prices, the electrical energy produced in them for the EPS is too expensive and this is the reason why operations of these power plants have been reduced to minimum.

The age of these plants is from 17 to 27 years. They were built according to the technology prevailing in the eighties but there were no subsequent modernizations of their energy efficiency. In addition to that, economic circumstances which have affected the whole country and reduced the volume of economic activities have caused first downgraded growth and then the abrupt fall primarily of heating consumers in industry, which is a decisive reason for current unsatisfactory energy efficiency of all three district heating and thermal power plants as they operate primarily in the condensation regime for which they have not, in fact, been designed.

It is important to have harmonization of price parties which can to a certain extent improve cost effectiveness of these plants. This should also be accompanied by certain investments in their reconstruction. The final solution may involve only extension/building of modern combined steam-gas plants of larger power.

§36. Consideration of existing conditions of electrical transmissions systems calls for natural needs of continuation of technological modernization of existing facilities in order to improve operating performances and reliability of electrical energy objects which is presently satisfactory.

§37. The first problems relevant to interconnecting operations of the electric energy system are noticed in the direction towards Romania (at the Hydropower Plant (HE) Đerdap), due to the surplus electric energy in the Romanian EES and towards Croatia due to the deficiency of power in the Croatian EES. By the construction of the TS Sombor 3, it is expected to increase the reliability of supply in the so called Sombor loop. The similar problem still exists in the so called South Banat loop which has also been designated as priority in the Transmission Development Strategy of the Company Distribution Grid of Serbia (Elektromreža Srbije - EMS).

The development of the power transmission grid of the AP Vojvodina is conditioned not only by the need to modernize the existing transmission capacities and revitalize electrical energy facilities in exploitation but also by the needs of consumers regarding the power supply. According to the forecasts until 2012, if realistic increase of electrical energy prices does not occur, the peak power of consumers in Vojvodina will grow to 1978 MW in relation to 1477 MW in 2004, or around 3,87% per annum with increased consumption of 1,3% per annum. Parallel with the development of the transmission grid, it is necessary to capacitate all functions of the technical control system in line with the manner in which the future electrical energy market will be organized.

§38. For the planning period from 2006 to 2012, it is anticipated that there will be the growth of electrical energy consumption of 8,2% and at the threshold of the transmission system, the consumption of 9422 GWh is planned. At the same time, it is planned to have stagnation of consumption in households and to reduce losses of electrical energy in transmission and distribution. In relation to 2004, this implies overall growth of 10,4% or at the average annual rate of 1,73%. This growth must be accompanied by corresponding investments in the reconstruction and building of: electrical energy objects (EEO), power lines of medium voltage (MV), low voltage grid (LV), modernization of distribution systems and purchase and installation of gauges. Modernization of distribution systems is reflected primarily in the application of distribution management system (DMS), in the construction of the transport optical telecommunication system and digital distribution, further development of the Distribution Management System and reduction of losses particularly increased in the last two years to as much as 20%. It is also necessary to replace existing around 850000 electricity gauges located at consumers with digital ones having options for remote reading, control and turn off.

## **5.2 Increase of Energy Efficiency and Energy Efficiency Fund**

§39. The first group of priority programs for increasing energy efficiency includes:

- a) For all sectors:
  - Introduction of compulsory existence of energy management for all energy users whose totally installed design power exceeds 1 MW (for all types of energy carriers and energy),
  - Raising total awareness regarding the need to use energy rationally,
  - Reduction of commercial losses in the power distribution system, and
  - Recompense reactive power and energy in the distribution system.
- b) For the sector of industry:
  - Reduction of specific consumption of energy carriers and energy by 15% in the period until 2010 and by 25% in the period until 2025 (for all types of energy carriers and energy),
  - Maximum stimulations for the utilization of renewable energy sources,
- c) For the sector of building construction:
  - Transfer from heating based on electrical energy to some other types of energy,
  - District heating systems for settlements. The new plants should be designed in such a way to maximize the use of biomass,

- Replacement of electric bulbs in households and business premises with “energy saving light bulbs”,
  - Replacement of doors and windows with new better insulated ones (PVC and the like)
  - Adoption of new regulations regarding outside design temperatures,
  - Consistent application of JUS U J5.600 from 1987, and
  - Transfer from lump sum payment to the computation of heating costs based on measured consumption of heat energy,
- d) For the sector of transportation:
- Definition, determination and adoption of the national strategy for the development of transpiration systems,
  - Coordination and harmonization of regulations in the Republic of Serbia with the regulations in the EU, and
  - Renewal of motor pools in all sectors.
- §40. The second group of priority programs for increasing energy efficiency includes:
- a) For all sectors:
- Creation of favorable environment for the utilization of modern energy technologies and their utilization.
- b) For the sector of building construction:
- Establishment of the stimulating fund for the improvement of thermal protection of existing residential buildings which are heated by means of district heating systems and centralized heating connected to natural gas and heated by electrical energy,
  - Adoption of regulations relevant to compulsory obligation to obtain building energy efficiency certificate for developers of new and owners of existing buildings, and
  - Introduction of an obligation to supply hot sanitary water from sub-stations or boiler houses to newly constructed buildings which will be heated by means of district heating systems.

§41. Large losses, irrational use of energy and worsened specific indicators of energy efficiency in our industry and other sectors, as well as the obvious lag behind countries members of the EU and countries in the surroundings relevant to energy indicators, impose the need to undertake systematic actions and incentives for setting up new standards in this field. The most important condition for the success of these actions is the existence of a motivating fund, stimulating and repressive measures for buyers of energy carriers and energy and primarily for: industry, public and communal activities and dominant consumers of final energy.

### 5.3 Utilization of Renewable Energy Sources

§42. Utilization of remains of farming and forestry production for energy purposes can be used both for meeting energy needs and as an important manner of deploying such wastes. Taking into considerations intension in the world and EU in this area, available quantities of biomass in the AP Vojvodina and objective benefits of this potential for energy purposes, the competent authorities of the provincial government (primarily the Executive Council, Provincial Secretariat for Energy and Mineral Resources, Provincial Secretariat for Agriculture, Forestry and Water Management, Provincial Secretariat for Economy, Provincial Secretariat for Science and Technological Development) should certainly in their respective domains coordinate the action and make utilization of biomass in the AP Vojvodina become fully affirmed in the period until 2012.

This implies building and adoption of a long term plan which will involve: education and promotion, construction of demonstration plants, selection and favoring highly energy efficient equipment, research and affirmation of biomass for cogeneration, subsidies and provision of loans for the implementation of projects fulfilling the established criteria and a variety of other program activities.

It will be also necessary to stimulate cultivation of energy plants at formerly untilled and desolate areas.

§43. Bio-fuels along with the biomass are certainly the second largest potential relevant to overall significance in the utilization of renewable sources of energy in the AP Vojvodina and affirmation of their use should be prioritized. Here, it is primarily meant the production of biodiesel, bioethanol, biogas, briquette and pellets from biomass.

§44. Geothermal potential in the AP Vojvodina is not large but it is attractive and suitable for small users and because of that it should have a deserved position in local energy balances.

§45. Solar energy has a high potential both for production of electricity (FN panels) and heat energy. If only a fraction of possibilities (565 GWh/a or 6,8% of today's electrical energy consumption) were used, substantial quantities of energy could be obtained. The problem is still in the economic sphere because of relatively high initial investments and relatively small production capacities. Therefore, this type of energy will remain in the background for massive utilization. This, however, does not mean that it should not be researched; progress in this area followed and solar energy deployed at the moment when justified needs occur and level of prices become acceptable.

§46. The potential of biogasa is insignificant. Its use is connected with relatively high investments. The construction and utilization of a large number of these plants is not realistic in the AP Vojvodina at this moment. .

The real reason for using biogas should be sought in the need to combust these gases as their role in generating greenhouse effects is large. As a rule, the aspect of environment protection is the main trigger for constructing plants which use biogas for energy purposes. The potential of municipal and other wastes in the AP Vojvodina is also insignificant but, as in the case of biogas, although these solutions are expensive, environmental reasons call for applying such technologies.

§47. Until 2012, it is planned to construct wind generators with the total power of 250 MW and annual production of around 450 GWh/a (about 5,7% of the today's electrical energy consumption). Based on formerly prepared studies in the regions of south and southeast Banat, the annual average wind velocity at the height of 100 m is 5 - 6 m/s, i.e., over 6 m/s, whereas in the remaining parts of Vojvodina, this speed varies from 4,5 - 5 m/s. At the height of 200 m, almost 35% of the territory of Vojvodina (southeast) has average wind velocity exceeding 6 m/s, whereas the remaining parts have velocities of 5 - 6 m/s. These potentials fall in the class 3 (yellow color in the EU classification with the 1-5 color code), and can be assessed as good (substantial) thus, providing grounds for more intensive construction of wind generators. The fast development in the industry of wind power plants in Europe, where capacities of around 66 GW are installed (end of 2008), growth of power for unit wind turbine (2 MW, with projections up to 10 MW) and the existing manufacturing for some parts of these power plants in the AP Vojvodina provide grounds for their construction. The problems still concern relatively high initial investments (around 1 mil. € / 1 MW with a falling trend to 0,8 mil. € / 1 MW), i.e., high production price of electrical energy in relation to the price from conventional power plants in Serbia. Therefore, there should be government stimulating measures for its utilization. The limiting factor is related to the capacities of the Electricity Industry of Serbia (EPS) to provide so called balance energy for already planned capacities and much higher price of this type of energy.

§48. Increasing the share of small hydropower plants in the overall production of electrical energy is a general preference of the world's energy policy and professional public and it has an important position in energy plans of all progressive economies. The EU gives special importance to this potential.

It is necessary to establish overall technically usable potential and proceed with the construction hydro power plants for deploying economically utilizable potential at this moment. The remaining potential should be protected against unplanned construction which can make it worthless as economically utilizable category varies in time.

The largest potential of the hydro system the Danube - Tisa - Danube, where small hydropower plants will be built within the existing sluices (including also the dam on the Tisa) as there are already constructed steps. The primary functions of the hydro system would still be the priority but "forced" operations could be applied for the purpose of increasing hydro-energy potential.

According to surveys up to now, it will be possible to construct 13 hydropower plants with the aggregate power of 20,2 MW and annual average production of 90,7 GWh (about 1,2 % of the today's consumption of electrical energy).

The use of hydro energy potentials will generate other benefits such as increased flow in the canal network (important from the aspect of environment protection) and dual function of some hydro power plants (pumps- turbines).

The potential at the rivers Karaš and Nera is evident although small. At the Karaš, there are three water steps which can be reconstructed and where it will be possible to construct turbines. It is estimated that the aggregate power of three hydro power plants will be 0,65 MW with average annual production of 3.2 GWh. The two downstream hydro power plants will be used in the future as pumps for reverse water supply from the canal DTD and for the purpose of irrigation. .

At the Nera, it is anticipated to reconstruct a derivation canal and construct four hydropower plants (general design has just been completed) with aggregate power of 1,2 MW and average annual production of 4,66 GWh. The derivation canal can be used for discharging rainfall waters and for water supply for irrigation purposes.

§49. In Vojvodina, there are 22 accumulations (10 at Fruška Gora, 10 at Telečka and 2 at the slopes of Vršački breg) constructed for the purpose of regulating water regime. It is estimated that at least at the half of these accumulations, it will be cost effective to built mini hydro power plants. Although the potential is not great, the construction will be very cheap as the turbines will be inserted in the existing pipe foundation outlets.

## 5.4 Building New and Capital Intensive Energy Capacities

§50. Further development of the Republic's unique gas system at the territory of the AP Vojvodina anticipates the increase of existing transport capacities from 6.100.000.000 m<sup>3</sup> to 6.800.000.000 m<sup>3</sup> per year by building the sections: Bečej – Gospođinci, Gospođinci - Sombor - Apatin, Gospođinci – Bačka Palanka – Odžaci, Gospođinci – Banatski Dvor (bidirectional), Ada – Bačka Topola, Tilva - Bela Crkva, Gospođinci – Beočin, Horgoš – Subotica, Bečej - Novi Bečej, Bačka Palanka – Šid in the total length of around 420 km.

§51. The constriction of the underground storage for gas is equally needed from the aspect of more favorable terms and conditions for contracting delivery of natural gas from Russia due to extremely variable consumption per seasons and safety and reliability of supply to buyers. The construction is underway. The final capacity of the storage will be 850.000.000 m<sup>3</sup>, which is around 25% of annual consumption in the Republic.

§52. Extremely unreasonable and in various respects dangerous road transport of oil derivatives in our country with around 70% share is dominant and for many reasons should be replaced by pipeline transportation as an imperative. In that respect, it is necessary to construct the product line which will connect oil refineries in Novi Sad and Pančevo a priority until 2011. This product line will enable the exchange of semi finished products between two refineries and transport of motor fuels from one region to the other.

§53. In addition to the connection between two refineries, it is also necessary to build branches of the product line Novi Sad – Sombor, Pančevo – Belgrade and Pančevo – Smederevo as the second priority. The first branch will enable the establishment of a distribution centre in Sombor for the northwest region of Vojvodina and export to eastern parts of Croatia. The remaining two branches are intended for the supply of Belgrade and northeast areas of central Serbia, i.e., central and south Serbia with the branch extension towards Priština. The construction of the product line should be accompanied by the construction of terminals in Novi Sad, Sombor and Pančevo with 4×5000 m<sup>3</sup> of storage area each.

§54. The construction of the Pan-European pipeline through our territories is strategically very important for various reasons. By entering into our territory at Bela Crkva and by expansion along the Deliblat sand pit and further on parallel with the Adriatic pipeline through our country up to Sotina, the length of the route will be around 195 km. This will: provide for the other independent direction of oil supply for our refineries and terminate monopolistic supply through Croatia, transportation costs will be significantly reduced (around 40% in relation to current costs), additional income will be generated by transit transport of oil through our country, increase deployment of our engineering ,

civil engineering and installation operative units, return confidence in the stability of the country by giving political and economical signals to potential foreign investors.

§55. The development of the pipeline should be accompanied by the construction of new reservoir capacities  $2 \times 10\,000\,000\,m^3$  at the terminal in Novi Sad and  $2 \times 15\,000\,000\,m^3$  in Pančevo.

§56. According to the Dynamic Economic Development (DED), totally expected needs of the Republic of Serbia in 2012 will be 4.300.000 t of oil and  $3.495.000.000\,m^3$  of natural gas which in relation to 2003 represents an increase of 14% for oil and 50,5% for natural gas. The existing relation between domestic production and oil imports has been mostly stable since 1990 up to now and amounts to around 23% towards 77% for oil and approximately 25% towards 75% for natural gas at the level of the whole country. This has been influenced by the reduced consumption caused by the decline of economic activities and concurrent decrease of domestic production. These relations are somewhat different for the territory of the AP Vojvodina (see the Figure 2 and §7).

§57. The Strategy anticipates reducing the country's reliance on imports. This is possible in two ways: by technical modernization of exploitation capacities in order to increase the production at the existing drills and by new research activities in the country and abroad (primarily in Russian and Kazakhstan). Until 2012, this will enable the accomplishment of the relation between domestic production and imports at the level of the whole country in the proportion of approximately 34% towards 66% for oil and around 14% towards 86% for natural gas. In all this, a significant role will be given to concessionary researches abroad which are common practice of all countries and companies in the world and even in our closest neighboring countries (Italy, Austria, Hungary and Croatia). Such a strategy must be imposed to the domestic oil company. Such a strategy should be imposed to the domestic oil company, as well. Behind that, there should be not only the company's expertise and technical capacities but also the Government and the competent Ministry. Taking into considerations the new circumstances which have arisen after the sale of the majority part of the NIS, it will be necessary to harmonize the Strategy with the new majority owner "GASPROM-NEFT" for the purpose of providing the reduction of imports dependence.

§58. In order to upgrade the quality of crude oil processing, reach fuel quality according to standards of the European market and attain the demanding level of environment protection, it is necessary to modernize refinery capacities. At the beginning of 2009, the NIS announced the first tenders for buying equipment aimed at the implementation of the program for technical modernization and reconstruction of the processing complex in line with the purchase and sale agreement relevant to 51 percent of stocks of the NIS to "GASPROM-NEFT".

§59. It is planned to continue works on the **Production Line System through Serbia** and to build the **Pan-European Pipeline**. There are two possible variants:

Variant "A" (000 m <sup>3</sup> )				
	Terminal	Until 2012	Until 2020	Until 2026
1.	SOMBOR	B 2 × 5	B -	B -
		D 2 × 5 + 1 × 3	D 1 × 3	D -
2.	NOVI SAD	B 2 × 5	B -	B -
		D 2 × 5 + 1 × 3	D 1 × 3	D 1 × 3
3.	BELGRADE	B 2 × 10	B -	B 1 × 5
		D 2 × 10	D 2 × 5	D -
4.	SMEDEREVO	B 2 × 3	B -	B 1 × 3
		D 2 × 5	D -	D 1 × 5
5.	JAGODINA	B 3 × 5	B 1 × 3	B -
		D 2 × 10	D 1 × 5	D 1 × 5
6.	NIŠ	B 2 × 10 + 1 × 3	B 1 × 5	B 1 × 5
		D 2 × 10	D 1 × 5	D 1 × 3

Variant "B" (000 m <sup>3</sup> )				
	Terminal	Until 2012	Until 2020	Until 2026
1.	SOMBOR	B 2 × 5	B -	B -
		D 2 × 5 + 1 × 3	D 1 × 3	D -
2.	NOVI SAD	-	-	-
3.	BELGRADE	-	-	-
4.	SMEDEREVO	B -	B -	B -

		D	1 × 3	D	-	D	1 × 5
5.	JAGODINA	B	2 × 5	B	1 × 3	B	-
		D	2 × 5 + 1 × 3	D	1 × 5	D	1 × 5
6.	NIS	B	2 × 10	B	1 × 5	B	1 × 5
		D	2 × 5	D	1 × 5	D	1 × 3

In the General Design, the value of the production line system is estimated to:

1. 163.783,3 million € for variant “A” and
2. 143.543,2 million € for variant “B”.

Underway is the preparation of the general design supplement and preliminary feasibility study with the tank at the Pančevo terminal as well (only two main pumps were planned and total infrastructure control).

For the whole system of product lines, the Plan of Special Purpose Areas is underway, which although delayed enables planning grounds for project implementation.

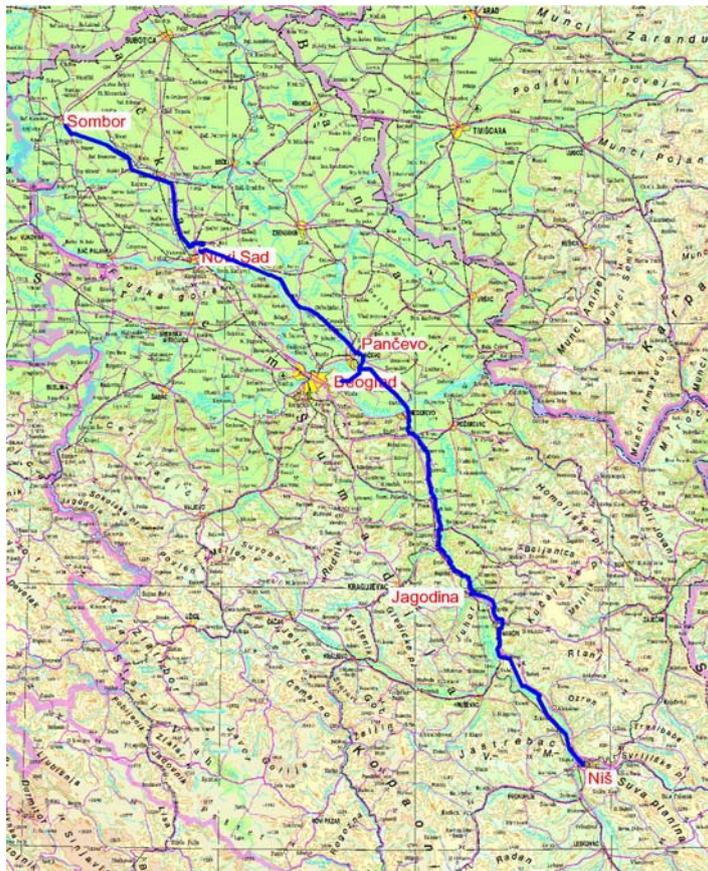
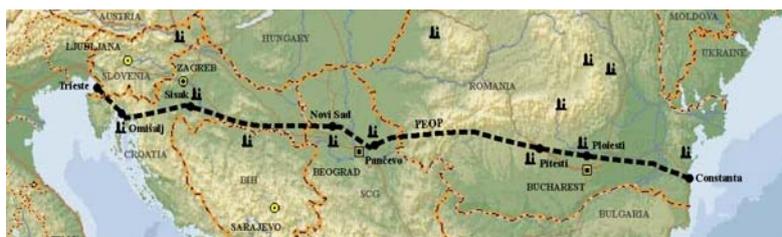


Figure 5.1: Route of the Product Line System through Serbia

§60. The Pan-European pipeline will connect the Black Sea and (Constance in Romania and Omišalj at Krk). In April 2007, the Ministry Declaration was signed by five countries involved in this project and the EU’s Commissioner for Energy as advancement of previously ratified Protocol accompanying the Framework Agreement INOGATE for the establishment of intergovernmental system for the transportation of oil. In the second half of 2008, the companies in empowered by their respective participating governments (JP TRANŠNAFTA (Public Enterprise “TRANŠNAFTA” on behalf of Serbia, JANAF on behalf of Croatia CONPET on behalf of Romania, etc.) established the

company for the development of the Pan-European pipeline with the head office in London. The company's mandate is to establish contacts with potential investors, financial institutions and political bodies for the purpose of investigating opportunities for privileged financing, obtaining loans under favorable terms and conditions and subsidies.

So far, not a single valid technical document has been prepared (in the sense of a law on planning and construction) for the pipeline's route through Serbia.



*Figure 5.2: Planned Route of the Pan-European Pipeline*

Long and painstaking negotiations are not at all unusual in case of capital line infrastructural facilities of international importance.

§61. For the Public Enterprise “TRANSNAFTA” to be able and respond to the requirements of its extending activities (storage of minimum compulsory/strategic) supplies of crude oil and oil derivatives for the country's demand, it will be necessary that the Serbian Government transfer to this company available tanks which are presently managed by the Republican Directorate for Commodity reserves particularly at locations which are in close vicinity of the pipeline infrastructure or the future system of product line. Perhaps one of the options can be the use of the tanks of the Oil Industry of Serbia (NIS) which will be in conformity with the Guidelines on determining obligations of the EU member states to maintain minimum reserves of crude oil and/or oil derivatives where the process of creating and maintaining strategic stocks of crude oil and oil derivatives is implemented through the cooperation between the state and economic subjects.

According to the Guidelines on determining obligations of the EU member states to maintain minimum reserves of crude oil and/or oil derivatives the process of creating and maintaining strategic stocks of crude oil and oil derivatives is implemented through the cooperation between the state and economic subjects. At the terminal of the public enterprise “TRANSNAFTA” in Novi Sad, it is planned to build at least two tanks of 10,000 m<sup>3</sup> each for such purposes.

§62. Adaptation of the communication system is underway and the remote control and supervision system at the route of the pipeline the Danube – Novi Sad - Pančevo started by laying the optical cable along the whole route in 2008. Its completion is expected to be by the end of 2009, together with the installation of active equipment (switches, network conductors) will fulfill a precondition for complete modernization of communication between facilities along the route and the introduction of the integrated remote control and supervision system of all components of the transport system thus enabling maximum utilization of the SCADA (“Supervisory Control And Data Acquisition”) system. It will also be necessary to adapt supervision – control units at block stations and station of cathode protection. The project involves also the system of video surveillance and introduction of the leak detection system.

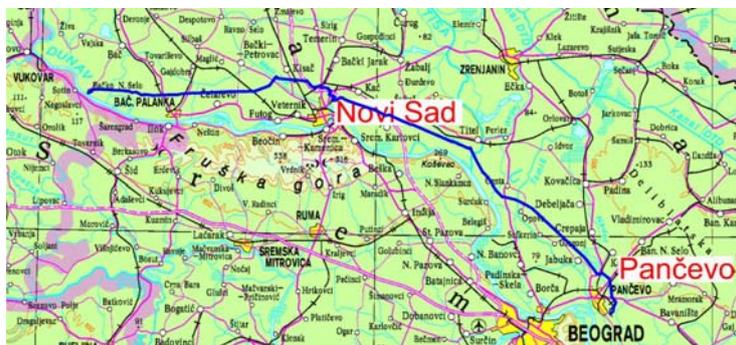


Figure 5.3: Route of the Pipeline the Danube - Bačko Novo Selo - Novi Sad – Pančevo along which an optical cable will be laid down

§63. Activities related to the provision of unobstructed and continuous operations and safe performance of all components of the oil transport system involve the following:

- Installation of mass flow meters for the purpose of commercial measurements with one commercial bridge meter at Bačko Novo Selo for the receipt of imported crude oil and the other commercial bridge meter for the receipt of domestic oil of the type “Kikinda” at the Novi Sad terminal,
- Purchase and replacement of valves at block stations along the pipeline route,
- Upgrading, maintenance and overhaul of the system for flow measurement at the measurement station Pančevo,
- Introduction of surveillance and management of the whole pipeline system from one centre,
- Extension and modernization of system in the transformer station,
- Overhaul of pump aggregates for crude oil transport.

§64. On the rivers the Danube, upstream from Đerdap (in the Novi Sad Zone) and the Sava in the Obrež Zone there is a hydropower potential which was studied in the eighties of the last century. It is possible to build a hydro power plant at the Danube with the capacity from 130 MW to 210 MW and average annual production of 985 to 1500 GWh (depending on the damming level). Out of the overall production, Serbia will get from 67,5 to 62,5 % and the remaining part will belong to Croatia and Bosnia and Herzegovina. It is proposed to start with the innovation of documentation (general and preliminary design) with the completion of the general design until the end of 2009 and preliminary designs until 2015.

Innovation of the general design of the Hydro Power Plant (HE) Novi Sad at the Danube is necessary due to the need to reconsider the location of the hydro power plant and the level of the damming in the sense of its raising. Also, it will be necessary to reconsider technical solutions for the protection of banks by deploying experiences in the protection against damming in case of the Hydro Power Plant Đerdap.

Before the preparation of technical documentation for hydro power plants at the Danube and the Sava, it will be necessary to make contacts with competent authorities in Croatia and Bosnia and Herzegovina for the purpose of harmonizing the principles of distribution of the potential and proportional participation in costs. .

§65. The construction of potential cogeneration plants with gas blocks and large power in the industrial zones of primarily: Novi Sad, Zrenjanin and Sremska Mitrovica, then Subotica, Sombor and Pančevo and even in other towns is strategically very important however, it must be based on actual consumers of heat in order to fulfil criteria for energy efficiency of consumers according to the Directive 2004/8/EC EU [8]. This particularly refers to Novi Sad, Zrenjanin and Sremska Mitrovica as the construction of new blocks on the basis of present demand for generated heat is not sufficient even for existing plants and it will cause later operations with unacceptably low degree of exploitation which will in turn take the plant into economically unfavorable position. This is especially related to the present price parity of basic energy carriers.

§66. The Agreement on the construction of the transit gas pipeline “South Stream” was signed between the OAO “Gasprom” and the Public Enterprise “Srbijagas” in Sochi, Russia on 15<sup>th</sup> May 2009. The construction of the gas line “South Stream” for alternative supply of Russian gas to the countries of Southeast and Western Europe will make Serbia an important node of the gas market in the region and in Europe.

The importance of the “South Stream” gas line construction is reflected in the following: provision of the alternative route for supplying Russian gas to Europe, better development opportunities for countries in the Southeast Europe as least developed and isolated gas market in relation to the surroundings, where Serbia will play an important role, Better stability of supply and further development of the gas system in Serbia, interconnection and diversification regarding gas systems of neighboring countries, possibilities for development and implementation of strategic joint ventures in the region, provision of better market conditions and more competitive prices of natural gas, positive impact on the overall economy of Serbia.

The envisaged execution of the Agreement implies: completion and putting into operation of the gas line “South Stream” is planned for the end of 2015, there is an important fact that all countries within the route of the “South Stream” have signed the Agreement, the investment value for the gas line “South Stream” is 20 billion US\$, total length of the gas line “South Stream” is around 3000 kilometers, total capacity of the gas line “South Stream” is anticipated at 31- 67 billion m<sup>3</sup>/a, the completion of the feasibility study for the whole route of the gas line “South Stream” is envisaged for the first half of 2010, the establishment of the joint Serbian – Russian company is anticipated by the end of June 2009 with the head office in Switzerland, the joint company will be 51% of the stake by the Russian side, that is by the OAO “Gasprom”. and 49% of the stake by the Serbian side, that is JP “Srbijagas”, the joint company will prepare the feasibility study for the portion of the route through Serbia until September 2009 and lay down the route of the gas line through the territory of Serbia.

Realization of the part of the route of the gas line “South Stream” through Serbia implies the following: the length of the route through the Republic of Serbia is about 450 kilometers of which 50 % will go through the territory of Vojvodina, the gas line capacities reserved for consumers in Serbia will be 4.4 billion m<sup>3</sup>/a.



Figure 5.4: The Gas Line Route through Serbia

Planned connections with the gas line “South Stream” are: the Node (GRČ) Gospodinci with the capacity of 2.2 billion m<sup>3</sup>/a and the Node (GRČ) Paraćin with the capacity of 2.2 billion m<sup>3</sup>/a.

Possible inlets from Bulgaria with routes up to the Node GRČ Gospodinci are:

- Vrška Čuka, Zaječar, Paraćin, Smederevo, Pančevo, Gospodinci
- Dimitrovgrad, Piroat, Niš, Paraćin, Smederevo, Pančevo, Gospodinci
- Knjaževac, Boljevac, Paraćin, Smederevo, Pančevo, Gospodinci

Possible outlets towards Hungary are:

- Bečej, Senta, Kanjiža, Horgoš
- Srbobran, Vrbas, Kula, Crvenka, Sombor, Bački breg

## **6. PROPOSAL OF MEASURES FOR PROGRAM IMPLEMENTATION, ASSESSMENT OF NECESSARY FUNDS AND FINANCIAL STRUCTURE**

§67. One of alternatives for the utilizing energy potentials of coal from Kovin is to construct the thermal power plant with the total electrical capacity of up to 800 MW. The implementation of this project is not realistic for the period up to 2012. Neither national nor provincial strategies have been defined in that respect and this period should be used for these purposes.

Drafting of the strategy can be realistically achieved in the period by the end of 2010. This requires coordinated action of all energy subjects from competent national ones to provincial and local authorities, manufacturers, distributors and buyer of energy and energy carriers. The construction itself could start by the end of 2012 and the investment would be about € 615 million.

§68. There is a reliable estimate of investments in distributed minimum production of electrical (around 770 GWh/a) and cogeneration heat energy (1040 GWh/a) and they are about € 95 million. For the variant with maximum cogeneration (around 2715 GWh/a) and simultaneous generation of electricity of around 1880 GWh/a, it will be necessary to invest about € 236 million. Both ideas are based on the use of natural gas with overall efficiency exceeding 85% and financially they are attainable for present and possible beneficiaries. With respect to the higher power variant, the Electricity Industry of Serbia (EPS) would join and both variants resolve majority of energy problems in industry.

### **6.1 Upgrading Technological and Operational Performances of Energy Facilities**

§69. Noticed problems of the gas line system will be overcome by the revitalization of the overall gas line system and by modernization of the control system. It is estimated that this investment requires € 5 million, which should be provided from: own resources of the Public Enterprise “Srbijagas”, loans and funds of the Republic of Serbia.

§70. The Strategy envisages further expansion of gas consumption particularly among small scale consumers by the construction of gas distribution networks. According to the plan for the territory of the whole Republic, for the construction of this network and household measuring sets, the amount of € 140 million will be allocated until 2012 from the funds of the Public Enterprise “Srbijagas” and the funds of the National Investment Plan. Hereby, it is envisaged to supply gas to 140.000 households in the AP Vojvodina.

§71. The Vojvodina’s part of the EPS (Panonian Power Plants) deals with an investment plan in 3 stages: (1) revitalization of existing TE-TO (€ 33,3 million), (2) Expansion of existing gas plants (€ 170 million) and construction at 5 new locations with the overall capacity of around 315 MW<sub>e</sub> (€ 157,5 million) and (3) environment protection (€ 1,6 million). All three stages (€ 360.8 million) are not sufficiently studied and their outcome is very uncertain.

The EPS and the City of Novi Sad are planning to launch an international tender, after they have established mutual company, for attracting strategic partners for the construction of the new gas-steam plant with 480 electrical and 300 heat power. Total investments for the construction of the new

block for the TE-TO Novi Sad are estimated to more than € 200 million. Launching of the international tender is expected by the end of September 2009.

Perhaps the revitalization of the TE-TO Novi Sad should be postponed as far as possible and study an option of a concessionary offer to the consortium of a dozen western European banks and companies (approximately € 550 million), which implies the reconstruction of the refinery and the TE-TO itself with 75% ownership for the period of 25-30 years and obligatory export of electrical energy while still expensive for our market. The similar procedure should be conducted for the location in Pančevo. The remaining investment plan should be compared with a more comprehensive option relevant to distributed cogeneration and make a decision on the basis of what is more favorable.

The revitalization and modernization of the cogeneration plant of the TE-TO Sremska Mitrovica should be coordinated with the transition process of “Matroz” and the Sugar Factory as key users of heat energy generated there. The expected level of investments is € 8 million.

For the implementation of other programs, it will be necessary to use regular funds of the EPS intended for maintenance of plants while the construction of the gas plant requires the participation of a strategic partner with an investment capital of around € 100 million.

§72. The investments in the development of the transmission network and telecommunication systems amount to around € 70 million. The major part is anticipated for new long distance power lines amounting to € 32,4 million (Su-So, So-SM, So-Hungarian border, direction towards Romania), new transformer stations amounting to € 20,84 million (TS So 3, TS NS 3, TS Sb) and replacement of existing equipment for telecommunication systems will require around € 1.6 million.

§73. The Program from the Table 6.1, some 68% of all investments, envisages for the transmission network 400 kV 13% for 220 kV and 17% for 110 kV network. Although these are capital investments, in their essence there is improvement of technological and operational performances of the transmission system. Around 65% of investments are anticipated for the construction of new electrical energy facilities and telecommunication network, 19% for revitalization and 15% for reconstruction of existing facilities. The implementation of this Program will accomplish the following:

- Raised safety and safety and reliability of electrical energy facilities
- Unobstructed connection of new consumers to the network
- Continuous supply of consumers with electrical energy and prescribed quality of power
- Reduced number and duration of breakdowns, i.e., no voltage breaks
- Improvement of voltage circumstances at consumers
- Reduced technical losses
- Reduced exploitation and maintenance costs by deploying new technical solutions
- Reduced modernization and automation costs
- Improvement of environmental situation by installing environmentally acceptable materials and by constructing facilities in line with environmental requirements

§74. Funds necessary for the implementation of the existing plan for the construction and reconstruction of electricity-distribution network until 2012 (for the network 110/20 kV, in details per years), which involve the construction of new, replacement or reconstruction of existing facilities, replacements at certain voltage mains, construction of low voltage grid, network modernization and purchase of gauges (total investment RSD **10,16 billion** or € 108 million) are given in the Table 6.1.

*Table 6.1: Financial resources necessary for the implementation of planned construction and reconstruction of electrical energy facilities and planned works on MV and LV networks and system monetization in the period from 2008 to 2012 [million RSD] (1 € = 94.2 RSD)*

Name	Total 2008 - 2012
110/xx kW	2403
Medium voltage mains	3248
Low voltage grid	957
Total electrical energy facilities	6608
System modernization	850
Purchase and installation of gauges	2700
<b>Total</b>	<b>10158</b>

## 6.2 Increasing Energy Efficiency and Energy Efficiency Fund

§75. Measures, expected energy and financial effects (for the medium price of about 0.03 €/kWh), size of investments and estimated simple pay back period for invested funds for priority programs set forth in §39 and §40 are shown in the Table 6.2.

§76. The establishment of a special purpose Energy Efficiency Fund, and the adoption of the National Program for the Rational Use of Energy, as well as the adoption of a special Law on Rational Energy Use are indispensable measures for planned increase of energy efficiency. These activities accompanied by coordinated actions of competent: national, provincial and local institutions should be programmed with an aim to reach European standards in the filed of energy efficiency and employ renewable energy sources.

The purpose of the Fund should be to stimulate and co-finance activities defined in the Program in order to increase energy efficiency and intensify utilization of renewable energy sources. In addition to the Fund of the Republic of Serbia, opportunities should be created for the establishment of funds at the level of the Province and at the level of local self-governments. This will further encourage inventiveness, resourcefulness and abilities from the local to the national levels.

§77. Possible sources of money for the work of Energy Efficiency Funds are: additional allocations from the final energy price, loans provided by international funds and financial institutions, revenues generated by the sale of rights to reduce gas emission causing the greenhouse effects, revolving funds, and the like.

Table 6.2: Measures for Increasing Energy Efficiency and Expected Effects:  
Abbreviations: energy (OEE), financial (OFE), simple payback period (PPO)

Measure Name	Effects			Investments	
	OEE [TWh/a]	OFE [€/a]	PPO [years]	Amount [€]	Source of proceeds
- Introduction of Energy Management	0,0268	1.000.000	-	-	Maintenance
- Raising awareness of the need to use energy rationally	-	-	-	-	Fund
- Lowering commercial losses in the power distribution system	0,2130	12.000.000	-	-	Maintenance
- Recompense reactive power and energy in the distribution system	0,1500 TVAh and 60 MVA	600.000 + 60.000.000 in building capacities	< 2	1.000.000	EPS
- Reducing fuel and energy consumption in industry for - 15% until 2015 - 25% until 2025	1,2072 2,0120	36.200.000 60.400.000	< 3	100.000.000 150.000.000	Fund, own, bank loans
- Transition from heating with electrical energy to some other forms of energy	0,4000	24.000.000	-	Not known	Systemic
- Replacement of electric bulbs in households and business premises with energy saving bulbs	0,2000	12.000.000	0,7	5.200.000	EPS, gift
- Adoption of new regulations regarding outside design temperatures	-	-	-	-	-
- Consistent application of JUS U J5.600 from 1987	-	-	-	-	No investment
- Transition from lump sum payment for heating and sanitary hot water to payment according measured consumption of energy	-	-	-	-	Maintenance
- Defining, drafting and adopting the strategy for the development of transpiration systems	-	-	-	-	-
- Coordination and harmonization of regulations in the Republic of Serbia with the regulations in the EU	-	-	-	-	-
- Renewal of motor pools in all sectors	-	-	-	-	-
- Creation of favorable environment for the use of modern energy technologies and their application	-	-	-	-	-
- Replacement of low efficiency electric motors	0,0700	4.200.000	> 15	75.000.000	Own
- Establishment of a stimulating fund for improving existing residential buildings insulation (envelope, windows) Insulation Replacement and repair of windows	-	-	-	78.000.000 157.000.000	Fund, Favorable loans, own resources
- Drafting regulations implying building energy certificate	-	--	-	-	Buyer
- Introducing compulsory supply of hot sanitary water to new buildings from the district heating system	-	-	-	-	Buyer

### 6.3 Utilization of Renewable Energy Sources

§78. Research activities in the field of the utilization of renewable energy sources should be based on the existing republican and national funds with a proposal to increase earmarked funds for these purposes substantially. The investment funds for the construction of simplest solutions for direct use of biomass for the purpose of meeting only heating requirements (on the basis of estimates for an average municipality in Vojvodina and construction of a larger number of boilers with the total power of 5 MW) amount for the whole territory of the AP Vojvodina to around € 36.000.000. If a dozen of small cogeneration plants on the basis of biomass worth around € 14.000.000 are added up, it is estimated that the investment of € 50.000.000 € for direct use of biomass for energy purposes can deploy the most prospective portion of this potential.

§79. For the implementation of the estimated potential annual production of 200.000 t of bio fuel in the AP Vojvodina, it is necessary to undertake the following steps: adopt clear strategic objectives relevant to the substitution of fossil diesel with biodiesel, stimulating measures in agriculture for the production of resources (primarily sunflower, oleic type, and then oil rape for this purpose), promote the use of biodiesel, oblige distributors of mineral diesel to compulsory mix up to 5% of biodiesel before its sale (primarily in agriculture) and introduce organized gathering of all waste greases. The implementation of bio fuel manufacturing at the territory of the AP Vojvodina requires approximate investments of around € 100.000.000. Sources of funds should be sought in stimulating measures of the state and financial institutions arising from benefits for the reduction of gas emissions causing the greenhouse effects, international special purpose funds and favorable loans, as well as private investment capital.

§80. For the purpose of estimating energy potentials of wind at the territory of the AP Vojvodina, the Wind Atlas of the AP Vojvodina [61] has been prepared according to the EU norms and by employing the recognized software tool WAsP. The construction of the first 100 MW envisaged in 2010, interested investors should provide around 100 M€, for envisaged 226 MW around 200 M€, while for 400 MW around 320 M€. (The price fall for 1 MW is expected from around M€/MW to 0.8 M€/MW).

§81. For utilizing hydropower potentials, it is necessary:

1. To innovate studies of hydropower parameters for the hydro system the Danube – Tisa – Danube and the river Tisa, needing around 80.000 €.
2. Preliminary designs for the Hydro Power Plant Novi Sad and Bečej are in the finals stage of preparation.
3. For the remaining three hydro power plants, which have been assessed as falling in the firsts category of profitability (dam at the Tisa, Vrbas, Kajtasovo), the preparation of preliminary designs requires provision of 366.000 €.
4. For the preparation of general designs of the second category (8 hydro power plants), it is necessary to provide 80.000 €, and for the preparation of preliminary designs, the same amount to the most. Preliminary designs will be prepared only for hydro power plants with positive economic indicators.
5. The preparation of the study of hydropower parameters for mini hydro power plants at discharges form accumulations requires the provision of 37.500 €.
6. The construction of five hydro power plants of the first category (dam at the Tisa, Novi Sad, Bečej, Vrbas and Kajtasovo) requires 27.000.000 €.
7. The proceeds for the preparation of technical documentation should be provided by the state and the construction of hydro power plants should be based on all other available investment potentials.

§82. The construction of the second category hydropower plants and mini hydropower plants requires the preparation of general designs and pre-investment reports and feasibility studies which should be started immediately and the less profitable ones should be left for some later stages.

§83. Utilization of Vojvodina's potentials in the area of renewable energy sources will not only enable better exploitation of existing resources primarily in agriculture but also provide opportunities for employing several thousand workers for designing, maintaining and accompanying services in this

field. This will create an additional stimulus for independent production or cooperation in developing manufacturing capacities for the production of plants and equipment for these activities.

Therefore, it is necessary to create opportunities for educating professionals involving all educational degrees in the field of utilizing renewable energy sources.

#### **6.4 Building New and Capital Intensive Energy Capacities**

§84. The construction of the underground gas storage was started by own resources of the Oil Industry of Serbia (NIS) and then by “Srbijagas”. In the National Investment Plan, the Government earmarked 11,50 million for 2006 and 2007, which will complete the first stage of construction of the capacity of 300 million m<sup>3</sup> and make the storage operational. For the purpose of continuing this project, the Government /Public Enterprise Srbijagas should allocate additional amount of 20 million €.

§85. The investments in the construction of capital intensive energy facilities for transport and storage of oil and oil derivatives at the territory of the AP Vojvodina is the part of overall investments for the development of these systems in the Republic of Serbia. These investments are estimated in the amount of 324.255.000 € for the first development period until the year 2011. The following structure of financing is envisaged: 10% of non-refundable proceeds of the Government, 20% of entrepreneurship capital and 70% of long term loans (out of that, 30% of commercial banking loans and 40% of government loans). Investments associated with the storage of oil and oil derivatives will depend to a great extent on the strategy of the new majority owner of the NIS which has so far been stated as developmental with increased investments in this segment.

Necessary investment funds for the implementation of the Program for Oil and Gas Researches are as follows: for new localities, 30.000.000 US\$ until 2009 and 30.000.000 US\$ until 2012, for new technologies, 20.000.000 US\$ until 2009 and 20.000.000 US\$ until 2012 and for concessionary researches, 130.000.000 US\$ until 2009 and additional amount of 130.000.000 US\$ (around 100 million €) until 2012. The programs for oil and gas researches both in the country and abroad, as well as necessary investments will be harmonized in the course of 2009 with the new majority owner and it is of crucial importance to maintain the continuity of investments in this sector. It will be necessary for the competent ministry and the provincial secretariat to build mechanisms for intensifying researches primarily in the periods after the expiry of existing research licenses.

§86. The priority funds for the modernization of refineries until 2009 amount to 257.000.000 € for the Refinery Pančevo and to 55.000.000 € for the Refinery Novi Sad. Financing of these activities started in 2009 by means of announcing tender for the purchase of equipment intended for implementation of technical modernization programs and processing complex reconstruction. Total investments in modernization of refineries until the end of the period specified in the Strategy Implementation Program are likely to be higher than previously envisaged.

§87. The following program is proposed:

1. Innovation of the general design for the hydropower (HE) Novi Sad requiring the provision of 1.200.000 €
2. Preparation of the general design for the HE Obrež at the Sava, requiring the provision of 650.000 €.

If positive economic indicators are obtained, it should be proceeded with the preparation of main designs which requires the provision:

- for HE Novi Sad at the Danube, 6 million €
- for HE Obrež at the Sava 3 million €

In case of all above mentioned proceeds, it is expected to provide proportional participation of Croatia and Bosnia and Herzegovina in accordance with the distribution of potentials. .

The state should provide resources for the preparation of above mentioned documentation and later investments will be based on all other available funding opportunities.

## **7. BARRIERS FOR THE STRATEGY IMPLEMENTATION PROGRAM**

§88. The Government of the Republic of Serbia, competent republican ministries, as well as the bodies of the Executive Council of the APV and competent secretariats will have the key role in removing barriers for the execution of the Energy Development Strategy Implementation Program. By means of duties and responsibilities of authorities, particularly legislative ones and accompanying inspection services, it is necessary to continuously remove and minimize effects of barriers in the execution of the Strategy and the Program.

### **7.1 Identification of Barriers and Measures for their Overcoming**

§89. The basic barrier for the construction of the pipeline for the transport of oil derivatives is the failure to define the route in the Spatial Plan of the Republic of Serbia. Taking into consideration the strategic importance of this object, it is an outstanding opportunity to designate special purpose areas in the announced amendments and supplements of the Spatial Plan and thus through the institution of the Spatial Plan remove this decisively important barrier for the implementation of the project of the pipeline for semi products and oil derivatives.

§90. Not less significant barrier will be embodied in resolving property and ownership legal matters with thousands of owners of plots on the route of the pipeline and localities for the pipeline terminals. In order to remove this barrier, the assistance of the Province and the State as a whole will be of crucial importance. Without their support, the implementation of the project will be impossible.

§91. Basic barriers for the implementation of the Program for Oil and Gas Research and Production in the Country involve in addition to uncertain resources the following: provision of earmarked financial resources, adequately organized restructuring and professional training. These barriers can be resolved only by deploying systematic approach and measures. It will be necessary to innovate legal regulations in the domain of concessionary rights related to oil and natural gas researches, as well as to revise the research program with the new majority owner of the NIS.

§92. Implementation of the Program for Small and Mini Hydropower Plants is faced with the problem of deficient legal support for the construction of objects of this category. It is necessary to elaborate bylaws arising from the Law on Energy or to prepare the new law which will comprehensively regulate all issues associated with the use of renewable energy sources in compliance with the EU Directives.

§93. Possible barriers are expected to occur in relation to the construction of hydropower plants at the Danube and the Sava mainly with reference to relationships with upstream countries to which relevant watercourses also belong (Croatia and Bosnia and Herzegovina), conditions for using land and protection of watersides. Resolving of these issues will require the key role of the State through competent ministries and secretariats.

§94. Extremely important barrier for the operation and construction of new cogeneration plants (centralized and distributed) in Vojvodina concerns the unrealistic parity of prices of electrical energy, natural gas and coal for thermal power plants (see §10) and deficient regulations which will treat cogeneration in the way imposed by current energy and environmental circumstances in the world. Because of that and because of assumed obligations arising from the involvement in the regional energy market, regulatory compliance of this area with the EU regulations is an indispensable task of our state authorities. It is proposed that provincial authorities insist on full legal regulation in this field.

§95. Another important barrier for the future development of existing cogeneration plants is almost complete disappearance of heat consumers in the system of TE-TO. Therefore, the development policy for these facilities and industrial zones should recognize clearly prospects for including naturally integrated heating and technological consumers in the systems of TE-TO.

§96. The basic barrier for rapid development and construction of plants for renewable energy in Vojvodina concerns the deficiency of bylaws which will definite stimulating measures in the form of

feed *in* tariffs in order to encourage production of electrical and/or heat energy from renewable energy sources. The deadline for enacting such a document according to international commitments of Serbia is July 2009.

§97. Except principal solutions and support provided by the Law on Energy, the use of biomass, bio diesel and other renewable sources of energy for energy purposes is not regulatory defined and this together with the low price of electrical energy are key barriers for the use of this potential in the extent it realistically deserves.

§98. Key barriers for the implementation of the Program for Increasing Energy Efficiency are of economic nature. This is by all means caused by unrealistic parity of prices of energy services and energy carriers in general and most of all by the relation between prices of electricity and fuels. Barriers also have their strong financial dimensions. The lack of investment funds in general and even for the needs of increasing energy efficiency hold puts back these programs in the background. The nature of barriers is also political. Due to the non-existence of a long term energy policy for end users of energy, the implementation of programs for increasing energy efficiency is not realistic. Barriers have strongly emphasized social dimension. Energy in the Republic of Serbia is not goods. Significant part of concerns associated with the social status of citizens is conducted through the price of energy and through the overall position of energy and energy carriers and this is not stimulating for the programs of increasing energy efficiency. Technical barriers at the moment are not very important, but the fact that due to obvious technical-technological lag behind the developed world and even the closest surroundings, there is a dose of uncertainty and resistance towards the acceptance of new technical and technological solutions.

Because of all above stated, it is necessary to urgently pass the Law on Energy Efficiency and to establish the Fund for Energy Efficiency as, among other things, these laws will also mitigate or eliminate numerous other barriers.

§99. With respect to the present position of energy and energy services, the leading role of the state for the purpose of increasing energy efficiency is inevitable. It will be reflected in enacting necessary laws, bylaws, control mechanisms, stimulating and oppressive measures and essentially important preparation of conditions required for making energy and energy services get gradually realistic market value. Then, the role of the state in the process of increasing energy efficiency will start to weaken because free capital will slowly take over implementation of these projects.

§100. Realistic parity of energy carriers' prices and energy services is the best and natural trigger for activities associated with increasing energy efficiency and utilizing renewable energy sources in all sectors. The only way out from this situation is its establishment with necessary social programs of the state for those categories of electricity end users who should be subsidised. For example, the relation between electricity price and natural gas price expressed in energy units (kWh) should be realistically be higher than 3.

## **8. LEGAL FRAMEWORK FOR THE IMPLEMENTATION OF PROPOSED MEASURES**

§101. Taking into considerations experience and good practice in the EU member countries, the set of regulatory and stimulation measures for energy efficiency should include the following:

For industry:

- Establishment of standards and procedures for energy audits in industry;
- Support for reduction of CO<sub>2</sub> emissions;
- Encouraging the construction of highly energy efficient cogeneration plants ;
- Improving environment protection system by increasing energy efficiency, and
- Creating conditions to include Serbia into the European Scheme for trading with units of emissions.

For buildings in general:

- Enactment and enforcement of regulations;
- Continuous organization of promotional campaigns for the purpose of raising awareness among citizens and setting up a network of information service;

- Affirmation of the system for the use of energy labels on household appliances;
- Introduction of energy consumption measurements and application of tariff systems for computation of heating costs in the district heating systems, and
- Financial support to physical persons in order to conduct measures for increasing energy efficiency.

With reference to public buildings and services, the set of measures should include:

- Drafting and enforcing building regulations;
- Regular inspections and control of boilers and air-conditioning and ventilation systems in buildings;
- Continuous organization of informative campaigns aimed at raising awareness among public sector employees;
- Obligation to introduce energy management;
- Provision of stimulations for increasing energy efficiency in public and commercial buildings, and
- Introduction of a design appraisal mechanism based on analyzing the building's service life costs.

For traffic:

- Prescribing stricter standards for the purchase of vehicles;
- Launching promotional campaigns related to energy efficient behavior in traffic,
- Planning and establishing energy efficient traffic systems, and
- Introduction of clean traffic projects.

For renewable sources of energy:

- Adoption and announcement of *feed in* tariffs for electrical energy generated from renewable energy sources;
- Provision of funds for functioning of the electrical and heat energy production system from these sources according to the *feed in* tariffs;
- Enactment of accompanying regulations.

**§102.** Funds (state, provincial, local) for energy efficiency and renewable sources of energy should be established with the status of legal entities and public empowerments. They can be established on the basis of amendments and supplements to the Law on Energy or by special law which will govern their establishment, activities, funding sources, purpose and manner of using funds, mechanisms for controlling execution of plans and consequences of their failure, as well as all other issues associated with the relevant fund's activities.

**§103.** Operations of funds will be defined by several year and one year activity programs. Activity programs of the Republic of Serbia's Fund will be prepared in compliance with the Strategy, Energy Development Strategy Implementation Program, Activity Program of the Agency for Energy Efficiency and other documents and regulations in the field of energy efficiency and renewable energy sources, as well as in compliance with international treaties and agreements to which the Republic of Serbia is one of the signatories.

**§104.** The operations of funds at the provincial and local levels will be defined in compliance with the Activity Program of the Republic of Serbia's Fund and specific plans and programs of provincial and local character.

**§105.** It will be necessary to enact comprehensive regulations for using bio fuels which primarily enable the application of the "Directive 2003-30-EC of the European Parliament and the Council Concerning Promotion of Using Bio Fuels in Transportation Sector", and prepare the rule book associated with the minimum contents of bio fuels in motor fuels, responsibilities of distributors regarding contents of bio fuels in fuels at the market, monitoring contents of bio fuels in fuels at the market and registration of distributors for bio fuels and then monitor implementation of such a rule book.

## 9. ACTION PLAN AND ITS IMPLEMENTATION CONTROL MECHANISMS

§106. The Energy Development Strategy and the Strategy Implementation Programs in the AP Vojvodina represent the basis for defining the Action Plan for the Period 2009 - 2012. At the same time, together with the adoption of the Action Plan, it is necessary to approve the control mechanism for its implementation.

§107. The Action Plan should in details define: measures, activities, funding sources, responsible entities and the schedule of implementation of the Program's priorities. The Action Plan should be enacted by the end of 2009.

§108. The control mechanisms imply the control of the implementation of items set forth in the Action Plan in the sense of operational, technical, financial and development aspects with defining the control officer, his competences, periods OF control, manner of revising the Action Plan and impacts on the enactment of higher rank documents.

## 10. CONCLUSIONS

§109. Due to their significance, the projects for the construction of the Pan-European pipeline and the system of pipelines for products have already been accepted by the Government of the Republic of Serbia as long term capital intensive strategic investments. The execution of these projects requires full commitment of all relevant participants in the country, primarily those related to responsible companies and banks.

§110. The most important and realistic way of reducing reliance on imports is the implementation of the strategy for getting out at the foreign concessionary oil market which should be accompanied by the execution and redefining of the strategy for oil and gas researches and production in the country. The coordination of this objective, as well as the schedule of its realization is the task of the competent ministry and the new majority owner of the NIS.

§111. At this moment, potentials for the construction of large cogeneration plants with the total design electrical capacity of 1495 MW, of which 655 MW in modern plants with high energy efficiency are very likely. The current disparity of electricity and coal prices for thermal power plants on the one side and natural gas and heavy oil on the other side represent the essential barrier in attracting foreign capital for the construction of these plants. It is necessary that the Government provides legal regulations, bylaws, pricelists and other prerequisites for the realization of this potential particularly in the area of measures for cogeneration production in compliance with the EU Directives and requirements anticipated for unique regional energy market of the Southeast Europe

### §112. Vertical Activities by Key Tasks regarding Energy Policy Measures

TECHNICAL SECTOR	Building	Industry	Power Plants, Thermal Plants and Utilities	Transport
TASK	Improvement of legislation , introduction of the "building's passport"	Energy management	Development of stimulating schemes for renewable energy sources and energy efficiency	Legislation, fiscal regimes, fuel standards
	Implementation of energy services in buildings	Improvement of services within renewable energy sources and energy efficiency	Distributed cogeneration of electrical and heat energy	Providing a supply chain and market for bio fuels
	Realization of public building projects as an example of a "Government in Action"	Electricity generation from renewable energy sources	Connection to the public distribution network	Providing a supply chain and market for alternative and other fuels
	Promotion of highly energy efficient technologies in building construction	Establishing minimum energy efficiency standards for equipment.	"Green" certificate t	Reducing transportation needs
	Education and training	Obtaining new technologies and evaluation of service life	"White" certificate	Economic instruments and stimulations
	Improvement of performances of existing private buildings	Intensifying market transformations	"Carbon trading" and certificate issue	Information, encouraging and education
	Financial schemes	Monitoring market transformation and launching new initiatives within energy policy	Legislation, fuel standards and norms	Marker for vehicles run by alternative fuels
Evaluation of needs regarding human resources development and rendering an action plan for this development				

**§113. Horizontal Activities by Key Tasks regarding Energy Policy Measures**

NON TECHNICAL FIELDS	Energy policy, legislation and market transformation	Sustainable energy development	Financial mechanism and stimulations	Monitoring and evaluation	Advocacy and promotion
TASK	Chain of applying energy policy from development to promotion and application	Promotion of sustainable development and mobilization of local stakeholders in the energy field	Investment schemes for program and project support in the area of renewable energy sources and energy efficiency	Follow up and evaluation of effects of various programs and measures in the area of renewable energy sources and energy efficiency	Dissemination of results of research, development and demonstration projects. (R&DD).
	Energy laws and bylaws with respect of sustainable development and decentralized generation of electrical and heat energy.	Planning utilization of renewable energy sources and energy efficiency at the local level	Conditions for fair competition	Methods, indicators and modeling future trends of development and energy policy.	Exchange of knowledge regarding best projects from various energy sectors.
	Energy planning in urban, semi-urban and rural areas	Establishing favorable conditions for local market development in the energy field and decentralized production of heat and electrical energy	Micro financial schemes	Elaboration of mechanisms for the exchange of experiences in the area of project follow up and assessment	Dissemination of programs and their results
	Promotion of successfully realized projects in all energy sectors	Support for establishing local and regional agencies for energy management as a support to local activities in the energy sectors	Financial mechanisms for stimulating innovation projects for various target groups		Public campaigns for understanding Vojvodina as energy sustainable society.
	Training and formation of network of energy policy creators, inventors, banks and project sponsors. Action Plan for execution of vertical activities				

## ACRONYMS

/a	annual production/consumption
APV	Autonomous Province of Vojvodina
DED	Dynamic Economic Development
DTD	Canal System the Danube - Tisa – Danube
EEO	Electrical Energy Object
EES	Electrical Energy System
EMS	Electrical Network of Serbia
EPS	Electrical Industry of Serbia
EU	European Union
LV	Low Voltage
RSD	Republic of Serbia's Dinar
MV	Middle Voltage
TE-TO	Thermal Power Plant – District Heating Plant
HSW	Hot Sanitary Water
mtoe	Million tons of oil equivalents
ktoe	Thousand tons of oil equivalents

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The task of experts was to propose amendments and supplements relevant to the whole text of the IMPLEMENTATION PROGRAM OF THE ENERGY DEVELOPMENT STRATEGY OF THE REPUBLIC OF SERBIA IN THE AP VOJVODINA (from 2007 to 2012), (June 2007).

The Professional Service of the Provincial Secretariat for Energy and Mineral Resources has also delivered their vision of the current program application and proposed its improvement.