Serbia

Country Profile

1. Overview of Electricity Supply

Serbia has been slower in developing long-term energy strategies and policies for their energy sector. There is a need for investment in the electric power system. More than a decade of under-investment and lack of maintenance have left the system operating at the edge of fundamental safety and reliability requirements. Current production levels are unable to meet countrywide demand for power.

The oil refineries in Serbia suffered significant damage during the 1999 bombing campaign. Some refinery reconstruction has taken place enabling about 70 percent of capacity to be brought back online. The natural gas sector did not sustain war damage. It is perceived that the use of natural gas in Serbia will increase to meet the country's energy demands. In order to achieve this increase, major investments will have to take place for pipeline improvement (Serbia-Energy).

Power plant capacity has been deteriorating over the last decade, while household power consumption has been steadily increasing. Transmission and distribution losses are among the highest in Europe.

A summary information table for Serbia is shown below.

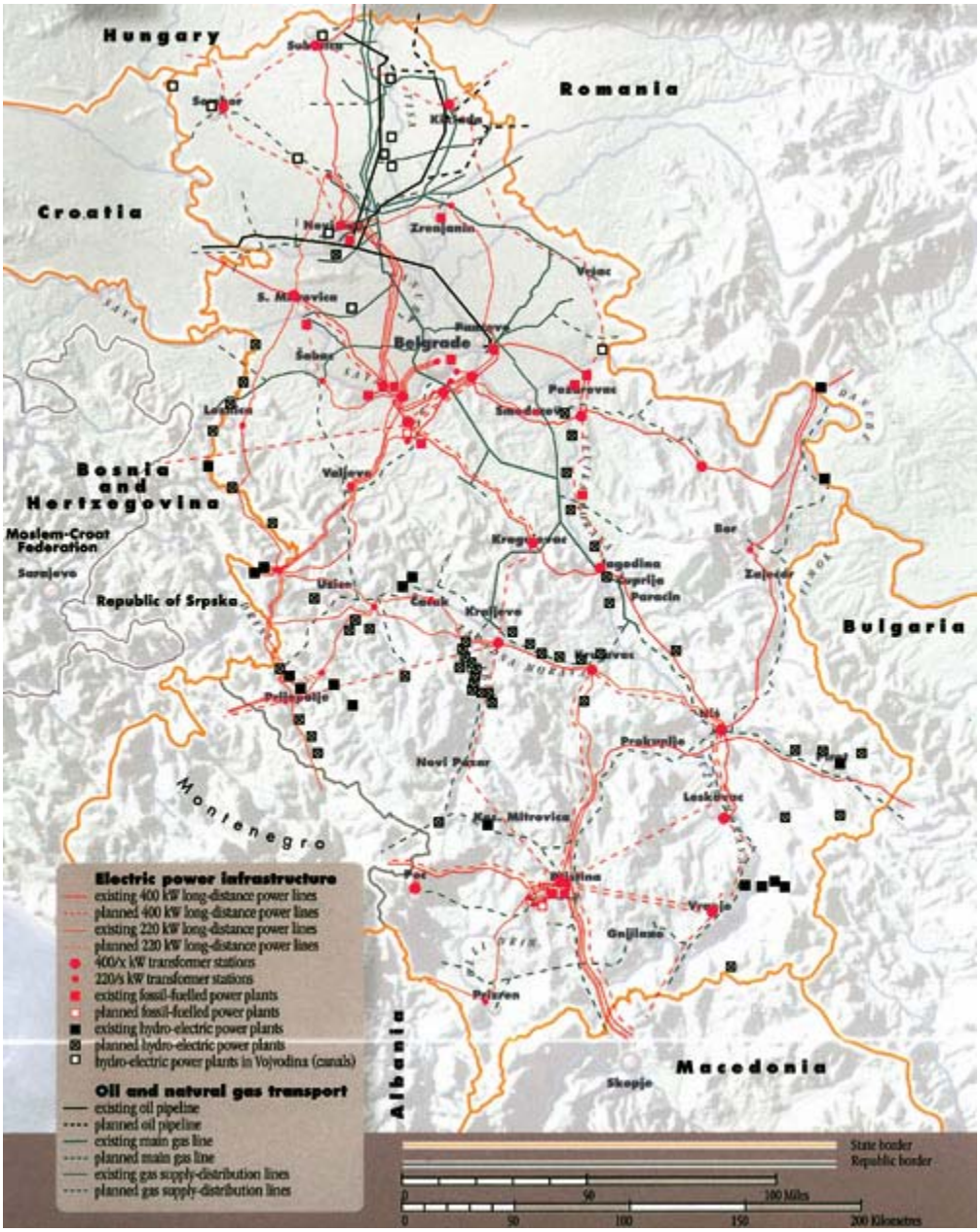
Demographical Information	
Population, millions (2009)	7.38
Land area, thousand sq km (2009)	77.5
Macroeconomic Information (2008)	
GDP, billion US$	80.7
Real GDP growth rate, percent	5.6
Foreign direct investment (net), million US$ (2007)	NA
Electricity disposition, billion kWh (2006)	
Generation	33.9
Consumption	NA
Exports	12.1
Imports	11.2
Generation, thousand GWh (2006)	
Nuclear	0
Thermal	25.5
Hydro	10.9
Other renewables	0
Total	36.4

Sources: CIA World Factbook, International Energy Agency, United Nations Conference on Trade and Development.

Serbia Country Summary Table

The map of the electricity grid is shown below. Much of the infrastructure needs to be updated with current technology to reduce losses and ensure improved power delivery. Only 16 percent of households are connected to the district heating system. Many households rely on autonomous heat sources in their home, mainly heating oil and coal (Source: Serbia-Energy).

Serbia's Electric Grid (Source: Serbia-Energy)



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2. Energy Policy, Barriers and Incentives

Serbian energy policy is primarily based on the Serbian Energy Law and the Energy Development Strategy up to 2015. Serbian policy is based on three crucial elements of sustainable development: competitive energy markets, environmental protection, and energy efficiency and use of renewables.

The Serbian Energy Development Strategy includes six different parts (Source: Serbia-Energy):

1. An assessment of the Serbian energy sector, energy consumption and production, national resources and constraints.
2. Information regarding the priorities, objectives, and program instruments to progress strategy.
3. A priority development program with an assessment of positive effects.
4. Forecasts of energy needs up to 2015.
5. Survey of the economic situation in the energy sector.
6. Proposal for monitoring and harmonization set priorities.

Serbia's Energy Law was entered into force in August 2004. The principles of the law include the following (Source: Serbia-Energy):

- Providing a quality and organized energy supply for consumers.
- Liberalization of the energy market in a non-discriminatory manner.
- Open access to all energy systems and energy supply networks.
- Priority access for renewable energy sources.
- Promotion of environmental protection and energy efficiency.

One of the challenges that face investors in Serbia is the lack of transparency in the energy sector. Despite the challenges, the Serbian government has partnered with the World Bank to create an incentive program to encourage investors.

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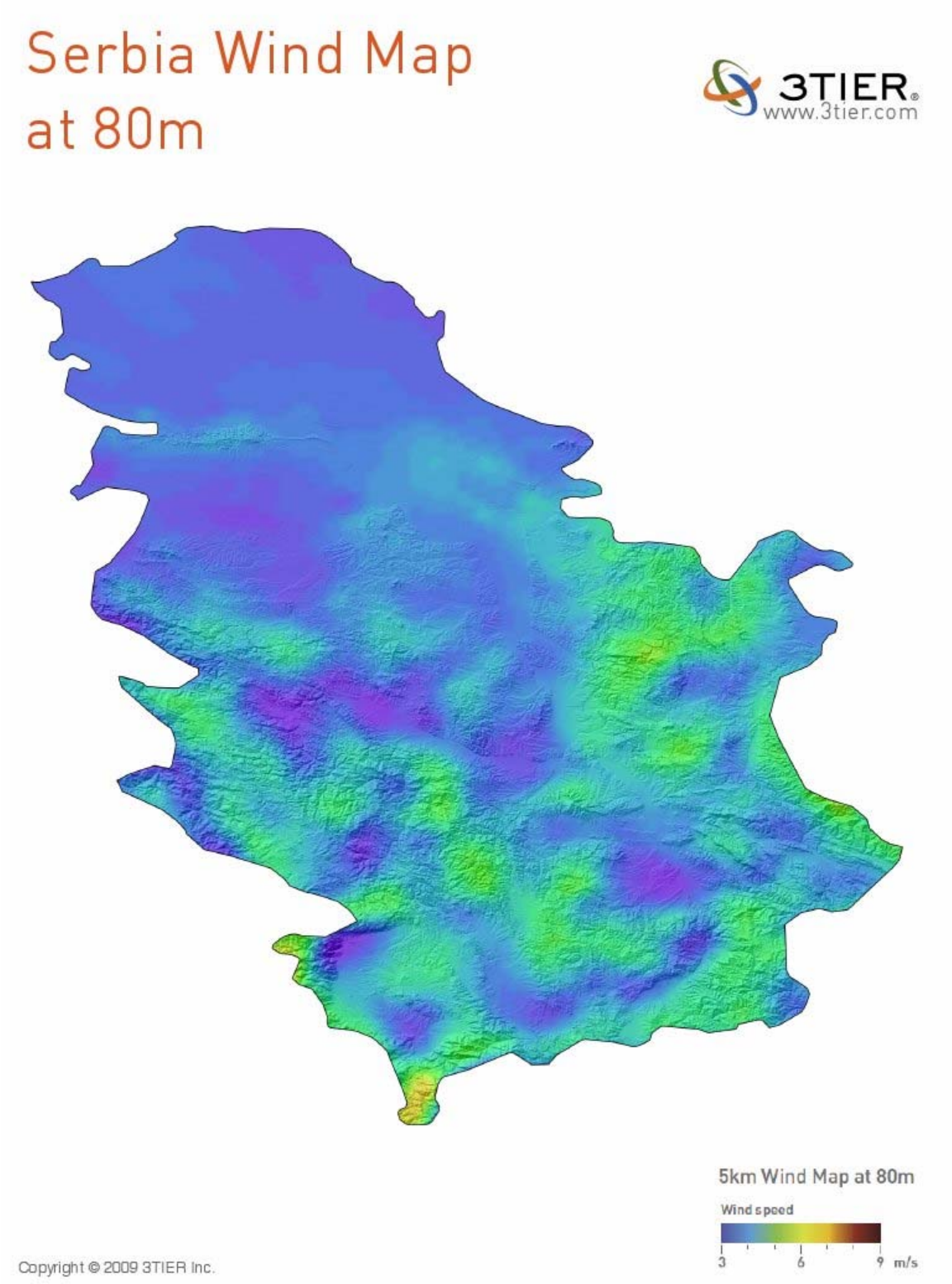
3. Wind

Serbia is estimated to have 2,400 GWh of wind potential. Areas with wind velocities above 5 m/s include Vrsac (leading with 6.27 m/s), Bela Crkva, Indijan, Irig, Kikinda, Sombor, Novi Sad and Sremska Mitrovica. Serbia's first windfarm is being built in Indija. It has 11 wind turbines and a total capacity of 25 MW (Source: Serbia Energy). Approximately 330 MW are planned for Serbia as well (UDI, 2009).

Measurements need to be taken to further assess the wind potential in the area; however, the areas listed below are believed to be suitable for the construction of wind turbines (Source: Serbia Energy).

- Eastern parts of Serbia - measured average wind velocity greater than 6 m/s in some areas. Regions in this area include Stara Planina, Ozren, Vlasina, Rtani, Deli Jovan, and Crni Vrh.
- Mountainous regions - regions include Pester, Zlatibor, Zabljak, Bjelasica, Kopaonik, and Divcibare.
- Pannonian Plain, north of Danube is suitable for construction due to high wind speeds as well as existing infrastructure (i.e. roads and electric grid).

Serbia Wind Resource Map (Source: 3Tier)



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4. Biomass

Biomass resources represent a significant potential energy source for Serbia. A study completed by the Serbian Ministry of Energy and Mining estimated that Serbia could replace 25 percent of their total energy produced with biomass facilities. The overall annual biomass potential in Serbia is approximately 28,000 GWh. The predominant source of biomass in Serbia is agriculture (70 percent) with the rest coming from woody biomass. Forests occupy nearly 20,800 km^2 of Serbia.

Many households currently use biomass or wood pellets for heating purposes. According to the Ministry of Energy and Mining, Serbia has the potential to turn 15 district heating plants into biomass heating systems. These 15 biomass plants could heat approximately 31,000 households (Trade Council of Denmark, 2008).

The table below displays biomass resource data for Serbia.

Biomass resource type	Total production	Production density
Total land area covered by	(avg. 2006-2007, km²)	(avg. 2006-2007, %)
Arable Land	33085	37
Permanent Crops	2995	3
Permanent Meadows and Pastures	14515	16
Forest Area	20834	24
Other Land	16931	19
Inland Water	NA	NA
Primary crop production	(avg. 2006-2007, tonne)	(tonne /100 km²)
Total primary crops (rank among COO)	14,849,689 (19)	19,168 (27)
Top 10 primary crops		
Maize	4,960,795	6,404
Sugar beet	3,197,643	4,128
Wheat	1,869,573	2,413
Potatoes	836,794	1,080
Plums and sloes	618,397	798
Soybeans	366,795	473
Grapes	356,399	460
Sunflower seed	339,724	439
Cabbages and other brassicas	302,424	390
Barley	267,319	345
Animal units, number	(avg. 2006-2007, number)	(number / 100 km²)
Cattle	1,101,093	1,428
Poultry	18,400,000	24,390
Pigs	3,605,262	5,162
Equivalent animal units	2,727,197	3,520
Annual roundwood production	(2006-2007, m³)	(m³ / 100 km²)
Total	2,928,500	3,780
Fuel	1,590,000	2,052
Industrial	1,338,500	1,728
Wood-based panels	119,500	154
	(2006-2007, tonne)	(tonne / 100 km²)
Paper and paperboard	238,000	307
Recovered paper	NA	NA

Source: Food and Agriculture Organization of the United Nations

Serbia Biomass Resource Data

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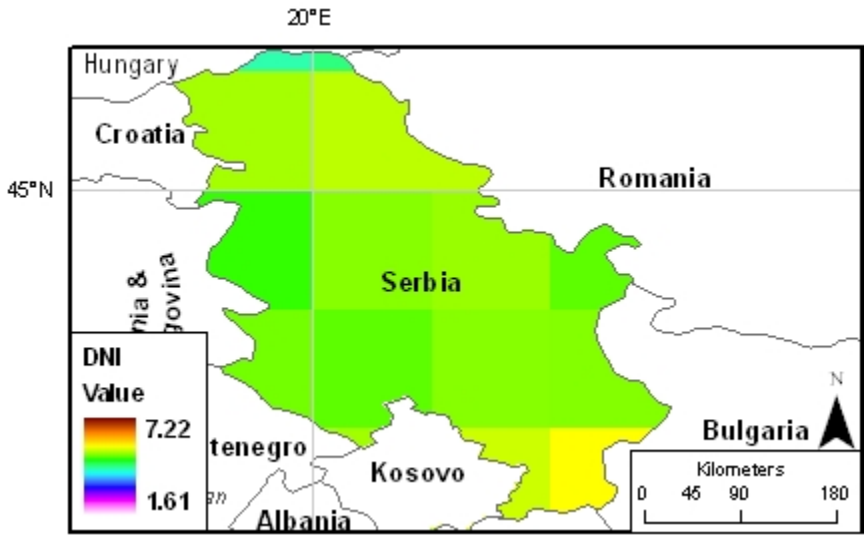
5. Solar

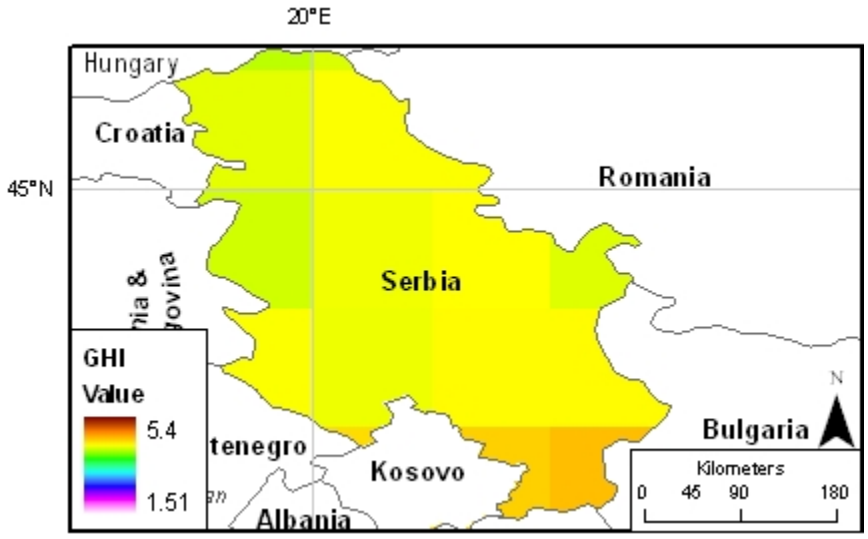
Serbia has some of the best solar resource in Europe. Its solar radiation average is around 40 percent higher than the European average. Annual solar irradiation for the country is approximately 1,400 kWh/m^2. The lowest measured values of solar radiation in Serbia are comparable to the highest values in the leading countries in solar utilization such as Germany and Austria.

The southern portion of the country has the highest solar potential, including the cities of Niš, Kuršumlija and Vranje. The following figures display the direct normal insolation values and the global horizontal irradiation values for Serbia.

Serbia Solar Direct Normal Insolation (Source: NASA)



Serbia Solar Global Horizontal Irradiance (Source: NASA)



Currently, most solar installations in Serbia are used for water heating in residential and commercial settings; however, plans are in the pipeline for Serbia's first power producing solar PV plant (BalkanInsight, 2008).

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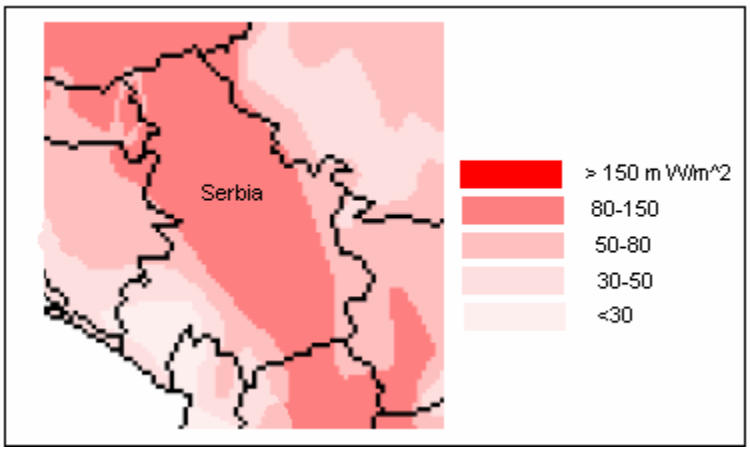
6. Geothermal

Geothermal investigations in Serbia began in 1974, after the first world oil crisis. An assessment of geothermal resources has been made for all of Serbia. Detailed investigations in twenty localities are in progress. The territory of Serbia has favorable geothermal characteristics. The follow figure displays Serbia's heat flow.

Serbian Heat Flow
(Source: Energie-Atlas GmbH)



There are four geothermal provinces. The most promising are the Pannonian and Neogen magmatic activation provinces. More than eighty low enthalphy hydrogeothermal systems are present in Serbia. The most important are located at the southern edge of the Pannonian Basin. The reservoirs of this systems are in karstified Mesozoic limestones with a thickness of more than 500 m.

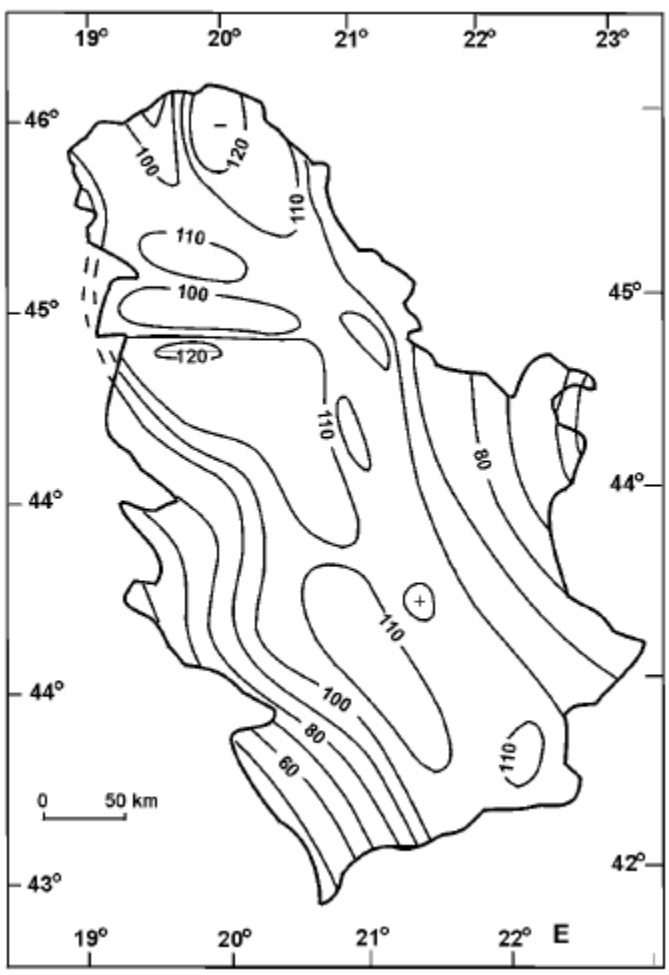
Geothermal energy in Serbia is being utilized for balneological purposes, agriculture (greenhouses, pig farms, poultry farms), industrial processes (carpet, leather and textile workshops) and space heating with heat exchangers and heat pumps. There are currently 59 thermal water spas used for balneology, sports and recreation, and as tourist centers. Nine mineral water bottling companies also bottle Serbia's thermal waters. The overall thermal installed capacity of Serbia is 89 MWt producing 2,375 TJ of energy annually.

Exploration to date has shown that geothermal energy use in Serbia for power generation can provide a significant component of the national energy balance. The prospective geothermal reserves in the reservoirs of the geothermal systems amount to 400 x 10^6 tonnes of thermal-equivalent oil. The prospects for use of heat pumps on pumped ground water from alluvial deposits along major rivers are very good.

For intensive use of thermal waters in agro- and aqua-cultures and in district heating systems, the most promising areas are west of Belgrade westward to the Drina, i.e. Posavina, Srem, and Macva. Reservoirs are Triassic limestones and dolomites >500 m thick, which lie under Neogene sediments. The priority region is Macva, where reservoir depths are 400-600 m, and water temperatures are 80 °C.

The economic blockade of Serbia stopped a large project in Macva: space-heating for flower and vegetable green-houses over 25 ha (1st stage). The completed studies indicate that thermal water exploitation in Macva can provide district heating systems for Bogatic, Sabac, Sremska Mitrovica, and Loznica, with a population of 150,000.

In addition to the favorable conditions for geothermal direct use from hydrogeothermal reservoirs in Serbia, geothermal use can also be made of hot dry rocks, as there are ten identified Neogene granitoid intrusions. Geothermal exploitation program have been prepared, but they have not been brought into operation. The figure below is a map of the heat flow in Serbia.



Heat flow map (mW/m^2) of Serbia

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7. Hydroelectric

The total hydro-power potential of Serbia amounts to about 25 billion kWh a year. About 17.5 billion kWh a year is classified as a technically and economically usable potential, of which about 10.3 billion kWh is utilized.

Serbia has approximately 2,770 MW of hydroelectric capacity, which generates a third of their power. A majority of the capacity is from 11 large power plants. Only about 30 MW of capacity comes from small hydroelectric plants (less than 10 MW). Serbia is looking to double its hydroelectric capacity with about 2,800 MW of planned capacity (UDI, 2009).

Serbia is also currently refurbishing two of their largest hydroelectric plants: the 382 MW Bajina Basta project on the Drina River and the 1,050 MW Djerdap 1 project on the Danube River. Reconstruction began in June 2009. The refurbishments should create a 13 percent increase in capacity (HydroReview, 2009).

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8. Relevant Links

Please see webpage for relevant links.

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9. References

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10. Country Contacts

Contacts made in the preparation of this assessment are gratefully thanked for their contribution to this report. Please see webpage for contacts listing.

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