

# Slovenia

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## 1. Overview of Electricity Supply

Slovenia has an installed power capacity of 2517 MW, with 1117 MW from thermal plants using fossil fuels, 768 MW from hydroelectric power, and 632 MW from the Krsko nuclear power facility.

Historical ties to Western Europe, a strong economy, and a stable democracy have assisted in Slovenia's transformation to a modern state. Slovenia acceded to both NATO and the EU in the spring of 2004. Also in 2004, Slovenia "graduated" from recipient to donor status with the World Bank. With this change, Slovenia is still eligible to receive limited technical assistance during the next two to three years.

Over the past few years, Slovenia's economy has steadily grown; their GDP growth has steadily averaged between two and three percent. In 2003, Slovenia's energy output decreased by over 500GWh, the direct result of a drought which decreased the output of their hydroelectric plants. Over 22 percent of Slovenia's energy comes from hydroelectric plants.

Slovenia has few indigenous resources of oil and gas. Imports of these fuels make up over half of the total primary energy supply. There are brown coal resources in the country, which account for 95 percent of coal consumption. It is expected that the present level of domestic coal extraction will be maintained over the coming years. Coal is of major importance to Slovenia both for heating and electricity generation. Slovenia is also moving towards the use of gas. The gas distribution system is expanding rapidly, and Slovenia is in a good position to benefit from being a transit country for various gas pipelines.

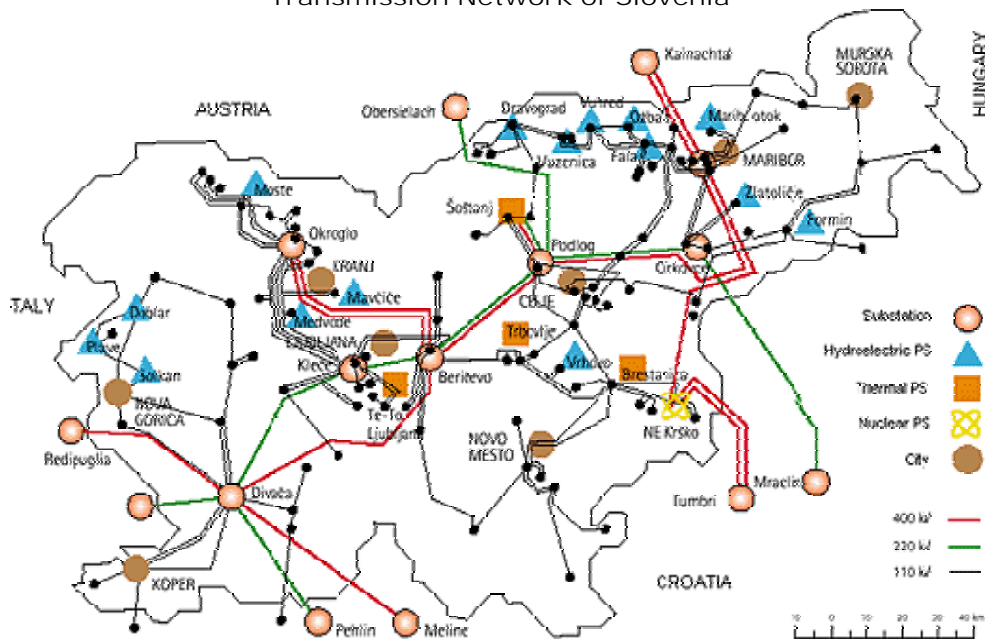
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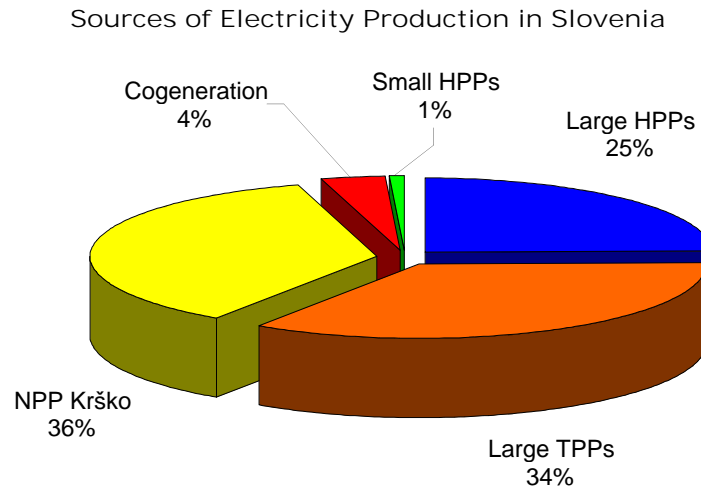
Demographical Information

Population, millions (2003)	2.0
Land area, thousand Ha (2002)	2,027
Macroeconomic Information (2003)	
GDP, billion US\$	27.8
Real GDP growth rate, percent	2.52
Foreign direct investment (net), million US\$	-118
Electricity sector	
Electricity tariff, US¢/kWh (2002)	9.2
Collection rate, percent (2002)	97
Load utilization factor, percent (2000)	NA
Electricity disposition, billion kWh (2003)	
Generation	13.23
Consumption	12.47
Exports	5.81
Imports	5.98
Generation capacity, GW (2003)	
Nuclear	0.7
Thermal	1.2
Hydro	0.8
Other renewables	0.0
Total	2.7

*Sources: European Bank for Reconstruction and Development, U.S. Energy Information Administration, Food and Agriculture Organization of the United Nations.*

Transmission Network of Slovenia





Source: Energy Agency of Republic of Slovenia

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## 2. Energy Policy, Barriers and Incentives

The Slovenian Energy Law was enacted in September of 1999. In addition to ensuring harmonization with related laws and practices of the European Union, the law aims to ensure the conditions for the development of a society with safe, permanent, reliable energy supplies. It seeks efficient use of said energy supplies, and economical use of renewable energy resources.

The Law also foresees the establishment of the Energy Agency, an independent regulatory body, which will be responsible for setting prices for electricity, fuel, and services.

The energy policy is focused on eliminating the consequences of and replacing non-environmental technologies which, by using energy resources, create products of combustion, the greenhouse effect (CO<sub>2</sub>) and generate nitric oxide (NO) into the atmosphere.

The energy policy encourages the use of alternative resources.

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## 3. Wind

There are no wind power plants installed in Slovenia, but there is a small amount of usage of wind energy in Slovenia for minor installations for recording purposes, or minor remote locations for water pumping and feed grinding

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## 4. Biomass

Biomass is an important renewable energy source in Slovenia. More than half of Slovenian territory is covered by forests, which represent a large biomass resource. Usage of biomass in Slovenia is seen as a way to reduce greenhouse gas emissions, reduce foreign energy dependence, increase synergy in other economic branches, and contribute to development of local, regional, and national economies.

Additionally it will help with efficient realization of contemporary environment politics in accordance with a national program of environment protection and EU direction. Together with measures of efficient energy use, biomass utilization for energy purposes can represent serious alternatives to fossil fuels.

In Slovenia biomass has been used mostly for individual heating and in district heating systems. It has only been used in a few small electrical generation systems.

In the country's wood processing industry there are about 80 wood waste boilers with capacities greater than 1 MWt. There are also two small municipal wood-fueled district heating plants. Other major installations are a 6 MWt facility in the city of Zelezniki that supplies hot water to local business, public and residential buildings. A 4 MWt unit is operating in the city of Gornji Grad, which also supplies hot water to public and residential buildings. Moreover, many rural households and farms use firewood as a fuel source.

Slovenia Biomass Resource Data

Biomass resource type	Total production	Production density
<b>Percent of total land area covered by</b>		
Forests	59%	
Shrublands, savanna, and grasslands	1%	
Cropland and crop/natural vegetation mosaic	40%	
Urban and built-up areas	0%	
Sparse or barren vegetation; snow and ice	0%	
Wetlands and water bodies	0%	
<b>Primary crop production, tonne</b>	(avg. 1999-2001, tonne)	(tonne /1000 Ha)
Total primary crops (rank among COO)	3,155,141 (26)	1,568 (13)
Top 10 primary crops		
Maize for Forage & Silage	1,058,951	526
Sugar Beets	405,401	201
Maize	293,221	146
Mixed Grasses, Legumes	275,000	137
Potatoes	192,072	95
Wheat	147,996	74
Clover for Forage & Silage	140,000	70
Alfalfa for Forage & Silage	130,133	65
Grapes	117,211	58

Apples	113,502	56
<b>Animal units, number</b>	(number)	(number / 1000 Ha)
Cattle	462,261	230
Poultry	7,150,000	3,554
Pigs	575,418	286
Equivalent animal units	763,928	380
<b>Annual roundwood production</b>	(1996-98, 000 m <sup>3</sup> )	(m <sup>3</sup> / Ha)
Total	2111	1049.2
Fuel	482	239.6
Industrial	1628	809.1
Wood-based panels	437	217.2
	(1996-98, 000 metric tons)	(metric tons / Ha)
Paper and paperboard	440	218.7
Recovered paper	65	32.3

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## 5. Solar

Adequate potential for low intensity solar energy has been identified. However, currently there is no widespread implementation of this resource. Limited use of solar energy for water and space heating has been observed, based on flat plate collectors. Photovoltaic applications have been implemented on an experimental basis in the telecommunications and other sectors, but solar technology has not yet reached wide scale of commercialization in Slovenia.

According to a study by Stritin, Arkar & others, measurement of environmental data has been made in Slovenia for many years. Included in the records were solar radiation data. The solar radiation is not uniform in a year cycle in Slovenia. The use of solar energy is therefore closely connected with energy usage and storage.

Average day values are presented in the table below for the towns of Ajdovscina, Brnik, Novo Mesto, Koper, Maribor and Ljubljana.

Location	Average day solar radiation
Ajdovscina	3,210 Wh/m <sup>2</sup> day
Brnik	2,950 Wh/m <sup>2</sup> day
Novo Mesto	3,030Wh/m <sup>2</sup> day
Koper	3,400 Wh/m <sup>2</sup> day
Maribor	3,010 Wh/m <sup>2</sup> day
Ljubljana	22,960 Wh/m <sup>2</sup> day

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## 6. Geothermal

The existing capacity of geothermal resources in Slovenia amount to about 103 MWt of heat plants providing heat to health spas, agriculture and institutions. Slovenia is extremely mountainous, and the country's complicated tectonic and stratigraphical setting is reflected in the Earth's thermal field. In the upper few kilometers of the crust, temperatures increase from southwest to northeast. The geothermal conditions in western Slovenia are influenced by the large crustal thickness in the Outer Dinarides and Southern Alps.

Geothermal exploration for high enthalpy resources on Slovenia began after the first energy crisis in 1973. Systematic geothermal investigation aimed at acquiring rock temperatures and their gradients, measuring thermal conductivity, and identifying the concentration of radiogenic elements in the rocks began in 1982. From 1995 to 2000, 18 wells with a total depth of almost 12 km were drilled.

As of 2000, Slovenia had an installed capacity of 42 MWt producing 196 GWh/yr. Geothermal resources are primarily used for thermal spas and recreation, space heating and cooling, greenhouses, industrial processing, and heat pumps. Reinjection is not currently used. Slovenia has an additional 64 MWt in unexploited, proven resources

Of the six countries in the Balkan region, four have high-enthalpy geothermal resources which may be suitable for power generation. Combined, the four countries have 32 sites with a temperature of 100°C or more. Based on political and economic stability, and a favorable regulatory framework, Croatia and Slovenia are the best candidates for geothermal resource development in the short-term.

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## 7. Hydroelectric

With an estimated 8,800 GWh/yr of technically feasible hydropower potential, only a third of which has been developed to date, and a desire to minimize import costs, increased hydroelectric power generation is a strategic objective of Slovenia's energy policy. An additional 1500 GWh/yr of electricity by 2010 is planned, requiring that 70 percent of the potential sites are exploited. In addition to large HPPs, small, mini, and micro hydro plants are being constructed.

There are three river systems in Slovenia. The longest of these is the Sava, which flows southeast across the middle of Slovenia; its basin, which includes its major tributary, the Savinja, drains the middle one-third of Slovenia before entering Croatia and eventually joining the Danube River at Belgrade, Yugoslavia. The Drava River also flows southeast across Slovenia before joining the Danube at Croatia's border with Yugoslavia; its basin, which includes its major tributary, the Mura, drains the northern one-third of Slovenia. The other significant river in Slovenia is the Soca (a.k.a. the Isonzo River), which flows southward through the western part of Slovenia before entering Italy and emptying into the Adriatic Sea. A map showing Slovenia's river systems is shown below.

## Slovenia's River Systems



Source: European Commission Regional Environmental Centre for Central & Eastern Europe

Hydropower supplies a quarter of Slovenia's electricity generating capacity. The Drava River is the major source of hydroelectric power in Slovenia. There are eight large hydroelectric plants in the Slovenian Drava cascade; all are owned and operated by the Dravske Elektrarne power company, headquartered in the city of Maribor, which was made part of the new Slovenske Hidroelektrarne holding company in June 2001. At average flow, the Drava cascade of power plants can produce more than 2.5 billion kilowatt-hours (kWh) of electricity per year; the Drava cascade covers about 37 percent of the country's total summer electricity demand and about 20 percent of the winter demand.

Two other hydroelectric operating companies were also brought into Slovenske Hidroelektrarne. Soske Elektrarne, headquartered in Nova Gorica, manages a cascade on the Soca River, representing about 90 MWe in total generating capacity. Savske Elektrarne, headquartered in Ljubljana, has four hydroelectric power plants on the Sava River, representing not quite 115 MWe in total generating capacity.

Renovation will increase the efficiency of these units, and could add as much as 150 MWe in generating capacity. Refurbishment the existing small scale hydropower units as well as increasing the capacity of the large-scale units are part of the Government's renewable energy strategy. The Slovene Government would also like to develop another five hydro sites along the lower Sava River, which could add about another 200 MWe of new hydro capacity to the system by 2010. A joint Slovenian-Austrian company, Sava, received the concession to construct these five hydroelectric stations, which will be located at Boštanj, Blanca, Krško, Brežice, and Mokrice.

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## 8. Relevant Links

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## 9. References

- Liz Battocletti of Bob Lawrence & Associates, Inc., Geothermal Resources in the Balkans, 2001
- Ministry of Environment
- Energy Agency of Republic of Slovenia

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## 10. Country Contacts

Contacts made in the preparation of this assessment are gratefully thanked for their contribution to this report. Contacts include: