

Slovenia

Country Profile

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1. Overview of Electricity Supply

Slovenia has an installed power capacity of 3,070 MW, with 1,360 MW from thermal plants using fossil fuels, 1,010 MW from hydroelectric power, and 700 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. In January 2007 Slovenia became the first 2004 EU entrant to adopt the Euro. Despite economic success, privatization has lagged in Slovenia since 2002, and the Slovenian economy has one of the highest levels of state control in the EU (CIA, 2008).

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 500 GWh, which was the direct result of a drought affecting 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. However, in July 2009 the EU Energy Commissioner noted that Slovenia was among the EU members that were least prepared for a potential gas crisis. New investments in the gas supply infrastructure must be made (STA, 2009).

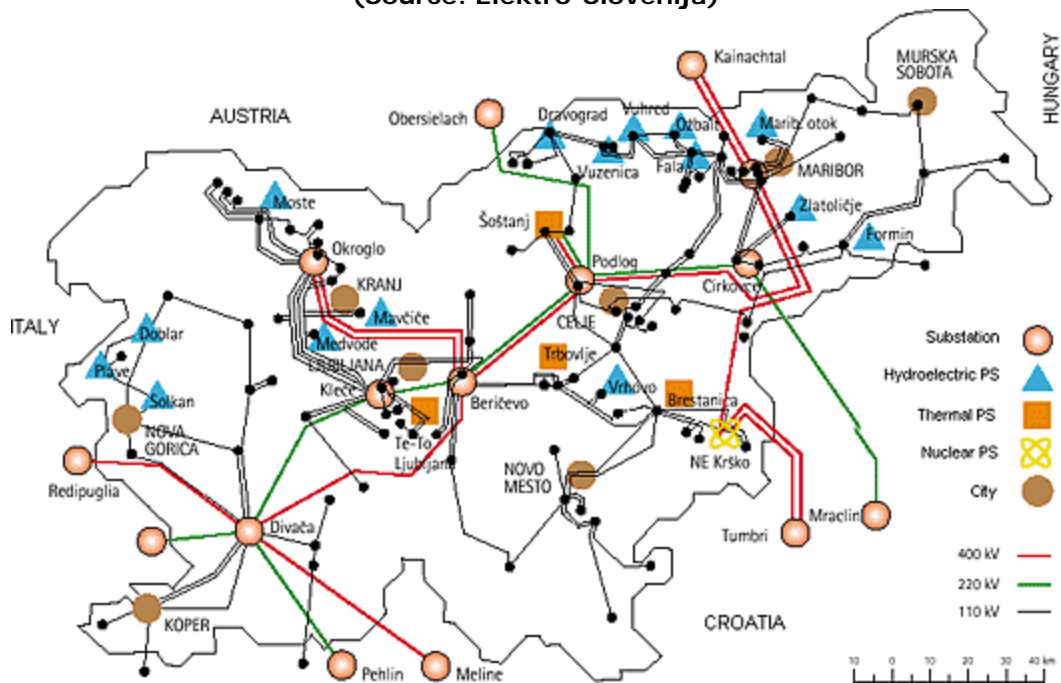
The table below displays summary information about Slovenia.

Demographical Information	
Population, millions (2006)	2.01
Land area, thousand sq km (2009)	20.27
Macroeconomic Information (2008)	
GDP, billion US\$	59.1
Real GDP growth rate, percent	4.30
Foreign direct investment (net), million US\$ (2007)	- 143
Electricity disposition, billion kWh (2006)	
Generation	14.13
Consumption	13.40
Exports	5.89
Imports	6.14
Generation capacity, GW (2005)	
Nuclear	0.70
Thermal	1.36
Hydro	1.01
Other renewables	0.00
Total	3.07
<i>Sources: CIA World Factbook, U.S. Energy Information Administration, United Nations Conference on Trade and Development.</i>	

Slovenia Country Summary Table

An illustration of the transmission grid for Slovenia is displayed below.

**Transmission Network of Slovenia
(Source: Elektro-Slovenija)**



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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 (CO₂) and generate nitric oxide (NO) into the atmosphere. Key elements for developers include

- A choice for renewable energy producers of fixed feed-in tariffs or premium feed-in tariffs from the network operators. A purchase agreement is created and valid for 10 years. The uniform annual prices and premiums are set at least once a year; however, from 2004-2006 the values remained the same.
- Subsidies or loans with interest-rate subsidies. Subsidies can cover up to 40 percent of the investment cost. Investments in rural areas without access to the grid are eligible for an additional 20 percent subsidy.

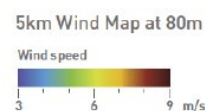
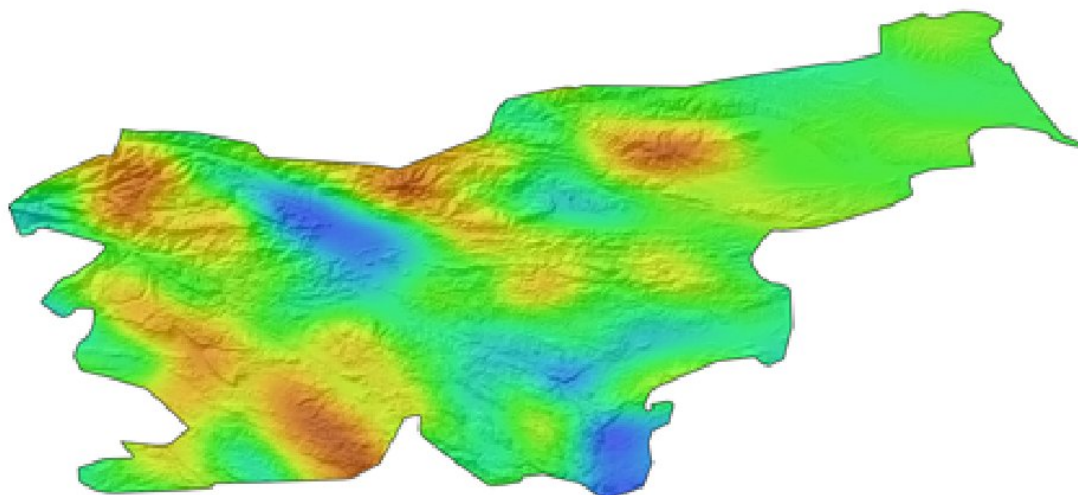
Keeping with the binding targets of the European Union, Slovenia's renewable energy target consumption is 25 percent (European Commission, 2008).

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3. Wind

Measurements have been taken at 12 different sites throughout Slovenia, and the wind energy potential has been estimated at approximately 600 MW (Gnamus, 2006). There are currently no wind power plants installed in Slovenia, but there is a small amount of wind usage in remote locations for water pumping and feed grinding. Slovenia has approximately 40 MW of wind power capacity in the planning process (UDI, 2009).

Slovenia Wind Map at 80m



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4. Biomass

Biomass is an important renewable energy source in Slovenia. More than half of the Slovenian territory is covered by forests, which represents a large biomass resource. Although only 4 percent of primary energy comes from wooden biomass, more than 30 percent of households in Slovenia still use wood for heating or cooking. It is estimated that 450,000 dry tons of wood from the forests could be harvested to produce energy as well as 120,000 dry tons from abandoned agricultural land. About 230,000 tons of wood residues out of the potential 361,000 tons are currently used in medium sized boilers (Krajnc, 2003).

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.

Biomass resource type	Total production	Production density
Total land area covered by	(avg. 2006–2007, km ²)	(avg. 2006–2007, %)
Arable Land	1,780	9
Permanent Crops	270	1
Permanent Meadows and Pastures	2,910	14
Forest Area	12,720	63
Other Land	2,460	12
Inland Water	130	1
Primary crop production	(avg. 2006–2007, tonne)	(tonne / 100 km ²)
Total primary crops (rank among COO)	1,257,402 (4)	6,203 (15)
Top 10 primary crops		
Maize	292,183	1,441
Sugar beet	261,016	1,288
Wheat	133,894	661
Potatoes	119,012	587
Apples	116,833	576
Grapes	114,015	562
Barley	64,764	320
Cabbages and other brassicas	25,161	124
Lettuce and chicory	13,675	67
Pears	11,635	57
Animal units, number	(avg. 2006–2007, number)	(number / 100 km ²)
Cattle	451,905	2,229
Poultry	2,946,500	14,536
Pigs	561,276	2,769
Equivalent animal units	705,880	3,482
Annual roundwood production	(2006–2007, m ³)	(m ³ / 100 km ²)
Total	3,030,388	14,950
Fuel	885,919	4,371
Industrial	2,144,470	10,580
Wood-based panels	693,000	3,419
	(2006–2007, tonne)	(tonne / 100 km ²)
Paper and paperboard	777,000	3,833
Recovered paper	150,000	740

Source: Food and Agriculture Organization of the United Nations

Slovenia Biomass Resource Data

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5. Solar

Adequate potential for low intensity solar energy has been identified. Limited use of solar energy for water and space heating has been observed, based on flat plate collectors. Between 2006 and 2008, approximately 100 kW of solar PV capacity was installed in Slovenia. The Energy Restructuring Agency of Slovenia installed the first solar PV plant that is connected to the grid. The PV plant is a pilot project, which will help promote and develop PV in Slovenia (APE, 2008).

According to a study by Stritin, Arkar & others, measurements of environmental data have 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.

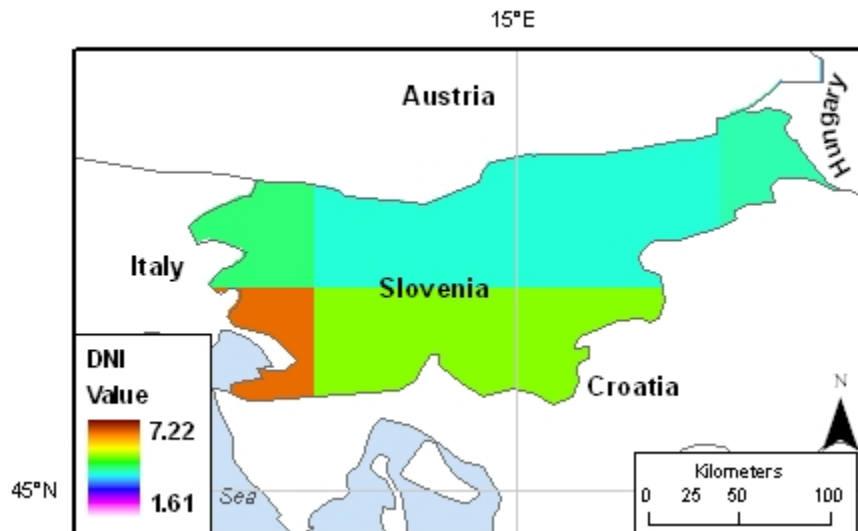
Average day values are presented in the table below for the towns of Ajdovscina, Brnik, Novo Mesto, Koper, Maribor and Ljubljana.

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

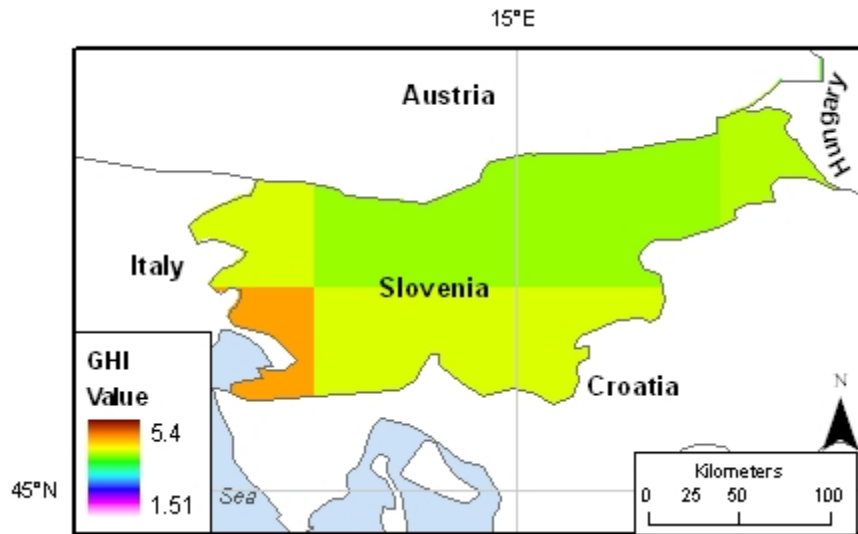
Average Daily Solar Radiation for Selected Locations

The following figures display Slovenia's direct normal insolation (DNI) and global horizontal irradiation (GHI) values. As shown, the greatest resource in the country is located in the southwestern region.

Slovenia Solar Direct Normal Insolation (Source: NASA)



Slovenia Solar Global Horizontal Irradiance (Source: NASA)

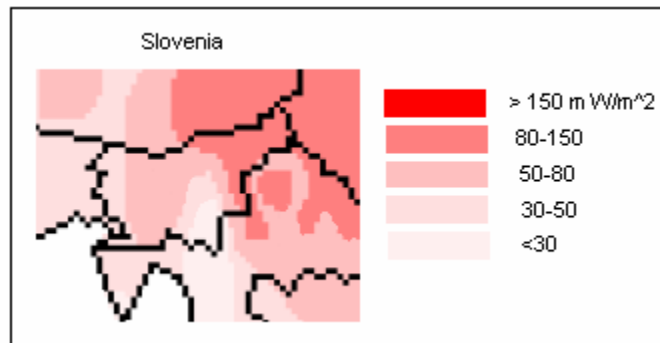


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6. Geothermal

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. The heat flow of Slovenia can be seen in the figure below. The Northeastern portion of the country has the greatest geothermal resource (80-150 mW/m²).

Heat Flow (mW/m²) in Slovenia (Source: Energie-Atlas GmbH)



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 2005, Slovenia had an installed capacity of 49 MWt producing 198 GWh/yr. Geothermal resources are primarily used for thermal spas and recreation and space heating and cooling; a

lesser extent are used for greenhouses, industrial processing, and heat pumps. Reinjection is not currently used. Slovenia has an additional 64 MWt in unexploited, proven resources

The high initial costs and low price of oil and gas attributes to low interest in geothermal heat pumps, but due to recent government funding and promotion of some private companies, the number of closed loop geothermal systems has increased. A total of 203 units have been installed that have a total capacity of 2.3 MWt.

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7. Hydroelectric

With an estimated 8,800 GWh/yr of technically feasibly 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. Slovenia currently has approximately 930 MW of hydroelectric capacity (UDI, 2009).

Three river systems exist 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, Serbia. The Drava River also flows southeast across Slovenia before joining the Danube at Croatia's border with Serbia; 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.



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

Hydropower supplies almost a quarter of Slovenia's electricity. The Drava River is the major source of hydroelectric power in Slovenia. The Drava River has a technical potential of 2,896 GWh of which 97.8 percent is being utilized (Kryzanowski, 2009). 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.

The Sava River has the second largest technical potential of Slovenian rivers. It has 2,794 GWh of usable potential; approximately 18 percent of the Sava is being utilized. The rest of the rivers have 3,455 GWh of potential with about 22 percent of the potential being utilized (Kryzanowski, 2008).

Refurbishing 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. Approximately 230 MW of capacity is currently under construction throughout the entire country; another 520 MW of capacity has been planned (UDI, 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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