MSc Program Renewable Energy in Central & Eastern Europe

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Future Potentials for Hydroelectric Power in former Yugoslav Countries and Albania

A Master Thesis Submitted for the degree of „Master of Science - MSc"

Supervised by
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Dornbirn, 01 September 2009

Affidavit

I Werner Kopp, hereby declare

1. that I am the sole author of the present Master Thesis, "Future Potentials for Hydroelectric Power in former Yugoslav Countries and Albania", 141 pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and

2. that I have not prior to this date submitted this Masterthesis as an examination paper in any form in Austria or abroad.

Dornbirn 01. September 2009 Werner Kopp

Abstract

The purpose of this Masterthesis is to provide up to date information as a marketing tool and a basis for decision making for the Hans Künz Company in its business segment of hydraulic steel structure production.

The South Eastern Europe (SEE) region and especially the successor states of Yugoslavia and Albania deserve more and more of our attention due its ongoing integration into the European Union.
Albania was long isolated from the rest of the European countries being under communist power. Bosnia Herzegovina, Macedonia and Serbia were a part of Socialist Yugoslavia for almost 60 years. All these countries are now on their own way towards free market economy and the participation in the European Union.

In this Masterthesis the current energy situation with a focus especially on hydropower in these countries will be evaluated. Decisive factors are the share of hydropower in total electricity production and the technically and economically feasible hydropower potential in these countries.
Further on the framework conditions for building new hydropower stations will be taken into account.
The last important factor for Künz is the market presence of European and especially Austrian companies in the single markets.

Kurzfassung

Ziel dieser Masterthesis ist es für die Firma Hans Künz GmbH aktuelle Informationen als ein Marketing Instrument und Entscheidungsgrundlage für den Geschäftsbereich Stahlwasserbau bereit zu stellen.

Die Region Süd-Ost Europa und im Speziellen die Nachfolgestaaten des ehemaligen Jugoslawiens und Albanien verdienen mehr und mehr Aufmerksamkeit im Bezug auf ihrem derzeitigen Weg zur Integration in die Europäische Union.
Albanien war als Land unter kommunistischer Herrschaft lange Zeit isoliert vom übrigen Europa. Bosnien-Herzegowina, Mazedonien und Serbien waren mehr als 60 Jahre lang ein Teil des sozialistischen Jugoslawiens. Alle diese Länder sind nun am Weg in die freie Marktwirtschaft und streben die Mitgliedschaft in der Europäischen Union an.

In dieser Masterthesis wird die derzeitige Energiesituation mit Hauptaugenmerk auf die Wasserkraft untersucht. Die entscheidenden Faktoren dabei sind der Anteil der Wasserkraft an der Gesamtstromerzeugung und das technisch und wirtschaftlich realisierbare Wasserkraftpotential in diesen Ländern.
Des Weiteren werden die Rahmenbedingungenfür den Neubau von Wasserkraftwerken mitberücksichtigt.
Ein letzter wichtiger Faktor für Künz ist die Marktpräsenz von Europäischen und im Speziellen von Österreichischen Firmen.

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Acronyms

%	percent
€	Euro
AG	Aktiengesellschaft
AHP	Austrian Hydro Power
BiH	Bosnia and Herzegovina
CHP	combined heat and power plant
Disco	Distribution Company
e.on	e.on Energie AG (Germany)
EDF	Électricité de France
eia	Energy Information Administration (U.S. Government)
EMS	Elektromreža Srbije
EnBW	Energie Baden Württemberg
EPCG	Elektroprivreda Crne Gore A.D.
EPS	Electric power industry of Serbia
ERE	Electricity Regulatory Authority
ERE	The Electricity Regulatory Authority (Albania)
ESM	Elektrostopanstvo na Makedonija
etc.	et cetera
EU	European Union
EVN	Energie Versorgung Niederösterreich
FBiH	Federation of Bosnia and Herzegovina
GDP	Gross domestic product
HPP	Hydro Power Plant
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IFC	International Finance Corporation
IMF	International Monetary Fund
KESH	Albania Power Corporation
METE	Ministry of Economy, Trade and Energy (Albania)
Mio	Million 10^6

Mrd	Milliard 10^9 (US= Billion)
N.C.	North Carolina
NAE	The National Energy Agency (of Albania)
REN	Renewable Energy
RS	Republika Srpska
RSD	Serbian Dinar
SEE	South East Europe
SEEA	Serbian Energy Efficiency Agency
SIEPA	Serbian Investment and Export Promotion Agency
STEWEAG	Steirische Wasserkraft- und Elektrizitäts-AG
SVK	Slovakia
TRCM	trash rake cleaning machines
UN	United Nations
USA	United States of America
VKW-VIW	Vorarlberger Kraftwerke - Vorarlberger Illwerke
ZEMAK	Association of Power Engineers of Macedonia

Units

Units of energy overview

Unit	Name	Conversion to kJ or kWh
J	joule	1 000 J = 1 000 Ws = 1 kJ
cal	calorie	1 000 cal = 1 kcal = 4.186 kJ
Wh	watt hour	1 Wh = 3.6 kJ
(kg) ce	(kilogram) coal equivalent	1 kg ce = 29 308 kJ
(kg) oe	(kilogram) oil equivalent	1 kg oe = 41 868 kJ
m³ natural gas	cubic meter natural gas	1 m³ natural gas = 31 736 kJ

Conversion factors for units of energy

	kJ	kcal	kWh	kg ce	kg oe	m³ natural gas
1 kJ	1	0.2388	0.000278	0.000034	0.000024	0.000032
1 kcal	4.1868	1	0.001163	0.000143	0.0001	0.00013
1 kWh	3 600	860	1	0.123	0.086	0.113
1 kg ce	29 308	7 000	8.14	1	0.7	0.923
1 kg oe	41 868	10 000	11.63	1.428	1	1.319
1 m³ natural gas	31 736	7 580	8.816	1.083	0.758	1

Other used units:

€	Euro
ce	coal equivalent
GWh	Giga Watthours
ha	hectare
km²	square kilometer
kW	Kilo Watt
m	meter
m³/s	cubic meters per second
mm	millimeters
Mtoe	Megaton of oil equivalent
MW	Mega Watt
MWh	Mega Watthours
oe	oil equivalent
PJ	Peta Joule
t	tons
TJ	Terra Joule

Motivation

Hans Künz GesmbH[1]

Image 1 Künz Headquarter in Hard on Lake Constanz (source: www. kuenz.com)

The Hans Künz Company in Hard on Lake Konstanz is one of the leading manufacturers of hydraulic steel structures in Europe. The company was founded by Mr. Hans Künz in 1932 and today is one of the oldest and most successful family owned enterprises in the Lake Konstanz region.

The beginning of Künz Company was a small metal working shop which produced different products for the local market. In 1936 the first derrick crane was built; soon after that the production of tower cranes. With the passing of time Künz expanded its product range to container cranes, heavy duty portal and bridge cranes as well as tank house cranes for the tin and copper industry and hydraulic steel structures for hydro power stations and trashrack cleaning machines.

Today Künz is an international operating company with locations in Hard (AUT), Gross St. Florian (AUT), Raleigh N.C. (USA) and Kechnec (SVK) and has formed partnerships with companies worldwide. The Hans Künz Company employs more than 300 personnel.

[1] Source Hans Künz GmbH, www.kuenz.com

Cranes

In the segment of cranes, Künz is focused on designing, building and putting into operation of container cranes, costume cranes (fully automatic handling cranes, customized assembly cranes, tank house cranes (fully automatic operating cranes for in tin and copper – refineries) and special heavy duty cranes like powerhouse cranes.
In the next photos on this page an impression of the product range can be seen

Image 2 Containercrane for intermodal operation METRANS A.S. Praha, CT (source: www.kuenz.com)

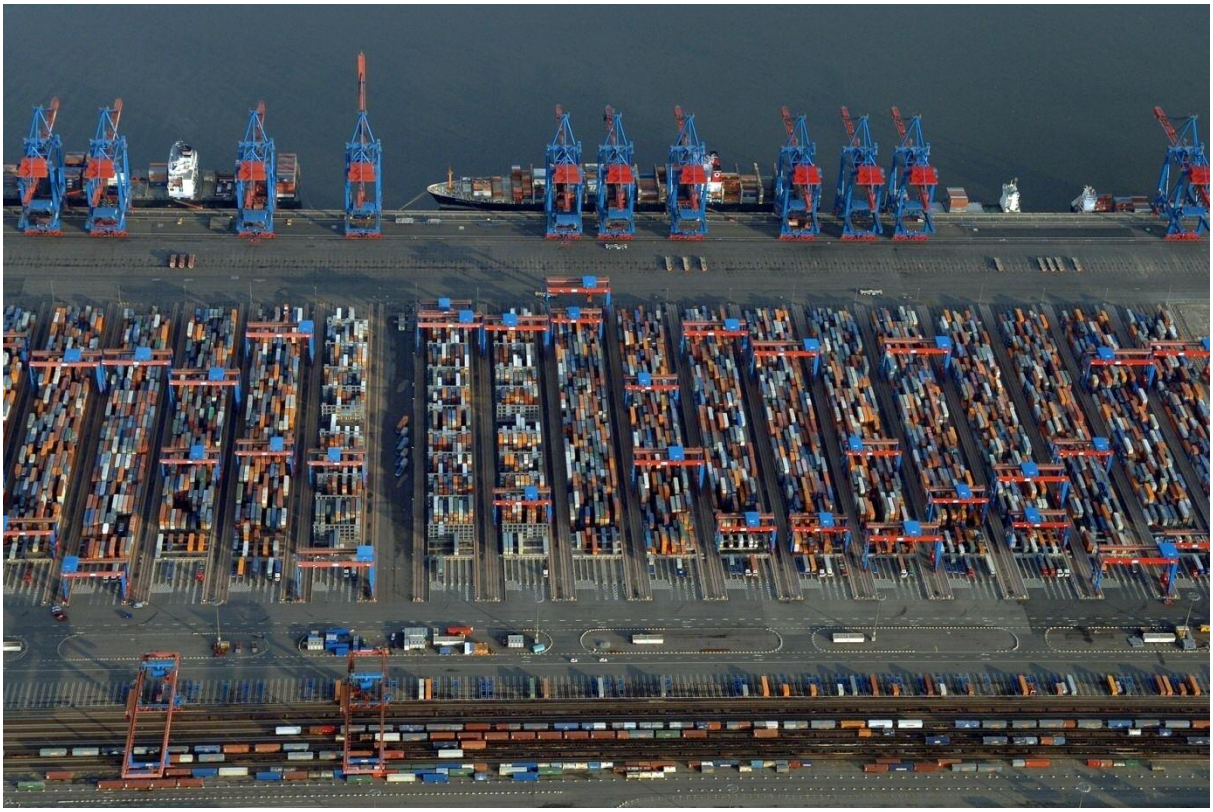


Image 3 - 52 pcs. of Stacking Cranes for Transshipment of all container sizes - HHLA Container Terminal Altenwerder GmbH, Hamburg, DE (source: www.kuenz.com)

References for cranes (selection)

- Xstrata, Switzerland
- Codelco, Chile
- Deutsche Bahn AG, Germany
- Duisport, Germany
- Energiedienst Rheinfelden, Switzerland
- EUROGATE, Germany
- METRANS,Czech Republik
- Rail Cargo Austria, Austria
- Salzburg AG, Austria
- RHENUS AG, Germany
- RRT – Rhein-Ruhr Terminal, Germany
- Verbund - AHP, Austria
- VKW-VIW, Austria

Hydraulic Steel Structures

Image 4 HPP Rheinfelden, De –radial gates (source: www.kuenz.com)

Weir gates, stop logs, trash racks, power house cranes – Künz is able to deliver the full range of steel hydropower equipment.
Künz hydropower equipment is tailored to the individual customer's needs. Decades of expertise in the hydropower sector have positioned Künz for the industry's renaissance. Künz is best suited for a hydropower industry renaissance)

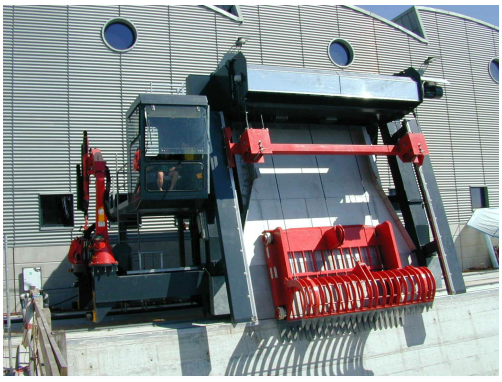
Image 5 Ship Lock, HPP Ybbs-Persenbeug, AT (source: www.kuenz.com)

References for Künz Hydraulic Steel Structures (selection)

- EON, Germany
- Aare-Tessin AG, Switzerland
- Energiedienst Rheinfelden, Switzerland
- LEW, Germany
- NOK, Switzerland
- Rätia Energie, Switzerland
- Salzburg AG, Austria
- Stadtwerke Innsbruck, Austria
- Steweag, Austria
- Tiwag, Austria
- Verbund - AHP, Austria
- VKW-VIW, Austria

Trash Rake Cleaning Systems

The efficiency of a hydro power plant is directly related to reduction of the head loss. Therefore, proper trash rake cleaning during full operation of the plant is a top priority.



Trash rake cleaning machines designed by Künz are optimized for efficiency.
In the Künz product range are conventional, rope driven TRCMs as well as hydraulic TRCMs.

Image 6 Trash Rake Cleaning Machine - Customer: Aare Tessin AG, CH (source: www.kuenz.com)

The hydraulic Trash Rake Cleaning Machine Type H-4000 which was built for Arkansas Electric, USA in 2005 is the largest Trash Rake Cleaning Machine in the world today. This machine is used particularly for sediment removal at the bottom of the intake and for the removal of large bulky debris. This has resulted in 10% more electric output compared to the time without TRCM

Image 7 Hydraulic Trash Rake Cleaning Machine TRMC H4000 - Customer: Arkansas Electric, US (source: www.kuenz.com)

References for Künz Trash Rake Cleaning Machines (selection)

- Salzburg AG, Austria
- EON, Germany
- Energiedienst Rheinfelden, Switzerland
- LEW, Germany
- NOK, Switzerland
- Rätia Energie, Switzerland
- Salzburg AG, Austria
- Stadtwerke Innsbruck, Austria
- Steweag, Austria
- Tiwag, Austria
- Verbund AHP, Austria
- VKW-VIW, Austria
- Alcan, Canada
- EDF, France
- NHPC, India
- State of Montana, USA

Finding new, potential markets is very important for Künz. Market awareness always means being ahead of competitors in knowledge of demand, potential and financing ability of new regions of business operation.

This Masterthesis shall provide a marketing tool for Künz. It also is intended to be an aid for making strategic decisions on how to approach potential new costumers in the evaluated countries. Second question is who are the decision makers and what are and who these costumers and decision makers are the principles of decision making.

Initial situation and scope of work

Based on the momentarily very difficult assessable situation in the field of hydro power plants Künz Company has decided to make possible to write a Masterthesis on the subject of "Future Potentials for Hydroelectric Power in former Yugoslav Countries and Albania".
The goal for Hans Künz Company is to gain a deeper knowledge for the market situation with respect of hydraulic steel structures in the described countries. In particular the short- and midterm potentials for building new hydro power plants and the potential for renewal and upgrading existing power stations are of particular interest.

For strategic reasons it is essential for Künz to know and to understand the existing legal principles, structures in energy business, existing networks and market players. The outcomes of this Masterthesis shall provide a basis for planning resources and market strategy.

Scope of duties

The Masterthesis has mainly three different tasks:

1. Research of legal fundamentals
2. Indentifying the market players and potential customers
3. Assess the market potential for hydraulic steel structures in the said countries.

In particular the planned new hydro power plants and the potential for refurbishing of existing plants shall be identified.

Area of study

The focus of this Masterthesis is located in South Eastern Europe.
Research will be done on the Republic of Albania and the former Yugoslav countries Bosnia- & Herzegovina, Macedonia and Serbia, because this four countries have a large natural hydro potential, rising energy demand, mainly old and inefficient power plants and are opening markets for European investors.

The fact finding is concentrated on power plants with an installed (- or planned) rated capacity of 5 MW or more. This is the defined scope of supply for hydraulic steel structures produced by Künz Company.

Goals

The goal of the Masterthesis is to provide a marketing instrument for Künz which shall support the marketing and sales department in indentifying and choosing new areas of supply and potential new customers and partners on the market.

Interpretation of collected information and data will be done in a second step within the Künz Company, which has the long term experience to work with such data and information.

Practical approach

At the begin of the work stood a comprehensive internet research to identify state organizations, hydro power operators and other market players.
Then a contacting followed with this identified bodies to get up to date information and data about existing and planned hydro power stations. Power plant operators, state organizations and renewable energy organization in the assessed countries were among the contacted organizations. Also the Austrian Trade Commissions in Sarajevo (for Bosnia and Herzegovina) and in Belgrade (responsible for Serbia, Macedonia and Albania) were contacted. From great help in this stage was also the personal contact to Mr. Stanko Peric, who already is representing the Hans Künz Company in the area.

The Masterthesis is split into the following parts:

1. Künz Company overview
2. Introduction to the scope and goal of the Masterthesis
3. Detailed country information about

    - Albania
    - Bosnia & Herzegovina
    - Macedonia
    - Serbia

Albania

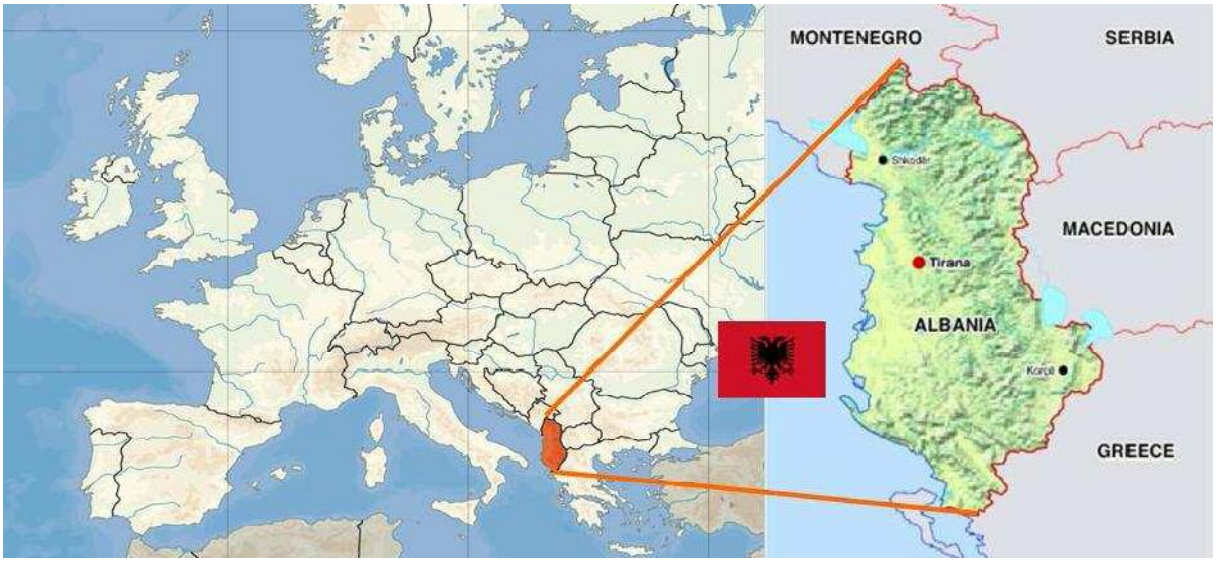


Image 8 Map of Albania on the European Continent (source: different internet public domains)

The Republic of Albania is situated in the south east of Europe. Its neighboring countries are Montenegro in the north, Macedonia, Serbia and Kosovo in the east and Greece in the south. To the west it has a coast on the Adriatic Sea and to the Ionian Sea to the southwest.

Albania is a member of the United Nations, NATO, the Organization for Security and Co-operation in Europe, Council of Europe, World Trade Organization, Organization of the Islamic Conference and one of the founding members of the Union for the Mediterranean. Albania has been a potential candidate for accession to the European Union since January 2003, and it formally applied for EU membership on 28 April 2009.

The population of Albania is 3.6 Million; The capital is Tirana with a population of 800,000 The biggest cities in Albania are Durres, Elbasan, Shkoder, Gjirokaster, Vlore, Korce and Kukes.
Its area is 28,748km². Highest point in Albania is mount Korab (2,753m above sea) its lowest point is sea level.

The official currency is "LEK" (1 Euro = 122.5 [2]LEK; as by September 2009)

The GDP (PPP) was and 6,800 US$ per capita in 2008. The following graph shows the Albanian GDP growth rate for the time from 1990 till 2004[3]

Graph 1 Source: World Bank, Albanian Institute of Statistics (INSTAT)

Albania was under communist regime for more than 50 years until 1992. During this time it was almost totally politically isolated from the rest of Europe. The only countries Albania had political and economical relations were China and until 1960 the former Soviet Union.

The country is on its way from centrally planned economy towards a free market economy.

The inflation rate in 2007 was 2.9%, in 2008 it was 3.4% and the prognosis for 2009 is 4.0%.

Biggest investor in Albania is the European Union. In the period from 1997 to 1999 foreign direct investment in Albania averaged only € 34.3 Mio, but in 2000 the rate of inflow tripled to € 110 Mio, was € 143 Mio in 2001[4] and reached € 463 Mio in 2007[5].

[2] Source Bank of Albania
[3] Source: CIA – The World Factbook https://www.cia.gov/library/publications/the-world-factbook/geos/al.html
[4] www.nationsencyclopedia.com/Europe/Albania-FOREIGN-INVESTMENT.html
[5] http://publications.wiiw.ac.at/files/pdf/FDI/fdi_june08_press_release.pdf

Infrastructure in Albania is far away from European standard. Roads and railroad tracks are in poor condition. Energy, water –supply and telecommunication grids need urgent renewal.

Legal Framework

The Ministry of Economy, Trade and Energy (METE) is responsible for the whole energy sector (oil, gas REN). It is also responsible to open the Albanian energy market for private investors and prepare the Albanian energy policy in line with EU energy directives.
METE is composed of the following three directorates: 1. electro-energy, 2. Hydrocarbons and mines (including coal) and 3. Industry. It has under its auspices the National Agency of Energy, the National Resources Agency, the Institute for Product Quality of Oil and Gas, Institute for Pressurized Vessels and Electricity Appliances, National Scientific Centre of Hydrocarbons Research (Oil and Gas Institute), and the Energy Efficiency Centre Albania-EU.

METE is the highest state authority and is responsible for energy policy making. The goal is to achieve a steady, sustainable economic development; this is done by:

- Preparation of papers and periodic revision and update through the National Energy Agency (NAE) of the National Strategy of Energy
- Drafting of the legal framework
- Demand forecast for different energy sources
- Promotion of private investments, domestic or foreign in the energy sector creating an attractive environment for these investments.
- Boosting of market reforms in the energy sector to achieve the national objectives for integration in EU, and development of a regional electricity market
- Support of the public energy companies for final privatization

In the year 2003 the Albanian government initiated the "National Strategy of Energy and Plan of Action" which led to the Albanian "Energy Efficiency law" in 2005[6].

[66] Source "The National Strategy of Energy and Plan of Action" (Ministry of Industry and Energy, National Agency of Energy, Albania 2003)

Main paragraphs of this law include:

1. to create a legal framework to promote and improve energy efficiency
2. to establish a more reliable energy supply chain
3. to reduce the environmentally impact of energy production
4. Implementation of an National Agency of Energy with the aim to implement and increase energy efficiency and REN systems
5. Regulations for investments for energy systems including small hydro power plants, biomass, wind etc.
6. To carry out energy efficiency and renewable energy awareness campaigns

Energy related organizations

In October 2005 Albania has signed the treaty for establishment of an European Energy Community in Athens, Greece.

Besides the METE the following organizations deal with energy related policies and standards:

The National Energy Agency (NAE)

Established in 1998 with the main tasks to prepare an Energy Strategy of Albania, to carry out studies for the promotion of renewable energy sources, to prepare, in cooperation with other institutions, the environment norms related to exploitation of energy sources and draft legal and by-legal acts in the energy sector

Electricity Regulatory Authority (ERE)

Established in 1996 it is an independent institution for Approval of rules and requirements for applications, granting, amending and withdrawing of licenses to companies carrying out generation, transmission, distribution, supply, export and import activities. It is also setting the wholesale and retail tariffs as well as terms and conditions of electricity service.
It is also responsible for the promotion of competition in power sector and the approval of market rules, grid code and other codes governing the licensees activities in the power sector.

Energy Efficiency Centre (EEC)

EEC was officially established in November 1995 with the full support of European Commission and Albanian Government. EEC is collaborating with other countries to promote and improve the energy efficiency of the Albanian economy and to protect the environment.
EEC provides the technical and other expertise to make this possible, and also promotes the use of renewable energy sources. EEC is the only specialized institution in Albania that works in the above mentioned fields, and now it has become a self-financed organization through providing services in the field of the rational use of energy, renewable energies, and its involvement in various programs and activities with the support of the Albanian Government and European Commission

National Oil Agency

The Agency was created in 1993 and regulates the oil and gas industries. It was established within the framework of the Synergy Program. SYNERGY was a co-operation program managed by the Directorate General for Energy and Transport (DG TREN) of the European Commission. It financed cooperation activities with non EU countries in the field of the formulation and implementation of energy policy to the mutual benefit of all parties concerned.

Ministry of Environment, Water and Forest Management of Albania

Mission of the Ministry of Environment, Forests and Water Administration is to draft and propose policies, strategies and action plans for the protection and administration of the environment, forests, waters and fisheries in order to achieve sustainable development, and to improve the quality of life and enable the country to join the European Union. The accomplishment of this mission is carried out through participation, initiation and coordination of the activities that lead to long term developments and well being, by protecting the nature and raising the awareness of the public opinion. The ministry may propose measures for the protection and preservation of the environment, forestry and water resources and is responsible for the implementation of water policy and forestry policy.

The Institute of Study of the Hydro Technique Units

It is an institute subordinated to the Ministry of Territory and Tourism Regulatory. This institute has undertaken a lot of studies regarding the possibilities of exploitation and construction of new hydro energetic capacities. In November 2006, the institute merged into the National Resource Agency as one of its departments maintaining the same tasks.

Energy Market Players[7]

Electricity Regulatory Authority

The Electricity Regulatory Authority (ERE) is responsible for regulating the performance of market participants. It sets and oversees the appropriate rules and regulations and in accordance with transparent procedures.

Distribution Company

The Distribution Company (Disco) owns, maintains and operates the distribution system in Albania. It is also responsible for buying energy, capacity and ancillary services for its tariff customers, and for purchasing ancillary services on behalf of eligible customers.
The Disco has the responsibility to provide to the transmission system operator annual, weekly and day-ahead schedules showing its expected load and that it has procured sufficient supply of energy and ancillary services to satisfy that load.
Disco is an independent, privately owned company since 2007.

KESH Gen

KESH – Albania Power Generation is the only company for the performance of services for generation, transmission distribution to the customers and exchange of electricity with neighbors.

[7] Source: http://www.enercee.net/albania/energy-market-actors.html

Small Power Producers

Small power producers are defined as: companies producing electric power by means of hydro power plants or combined heat and power plants with a rated capacity of 5 MW or less.
This producers are licensed to produce power and sell capacity and energy to Disco, to the export market or to eligible costumers at commercially agreed upon terms, or if no agreement can be achieved an terms which have to be approved by ERE.

Independent Power Producers

Independent Power Producers, producing electrical power with hydro power stations or combined heat and power plants with a power rating in excess of 5 MW can sell energy or capacity to the export market or to eligible costumers at market prices. The price for selling energy to the Disco has to be approved by ERE.

External Suppliers

These external power suppliers, which are situated outside the country of Albania, can export power to KESH Generation, to distribution companies and to eligible costumers.

Albanian Electro-Energetic System

The following map shows the Albanian electric power system including power stations and transmission lines updated in 2008.

The big issue in electricity transmission and distribution in Albania are the high losses of about 25% of total electric energy. These losses are mainly caused by electricity thefts.

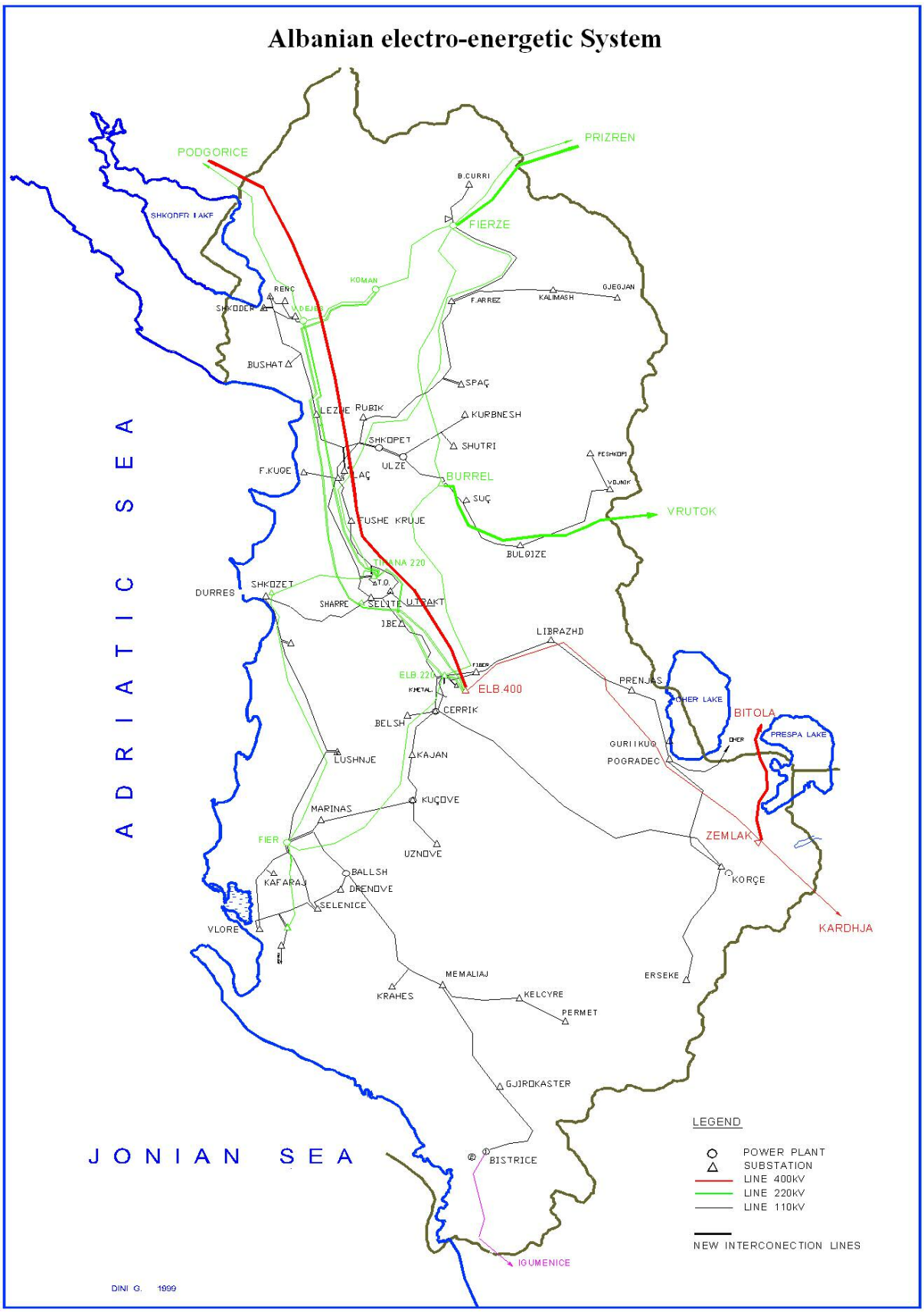
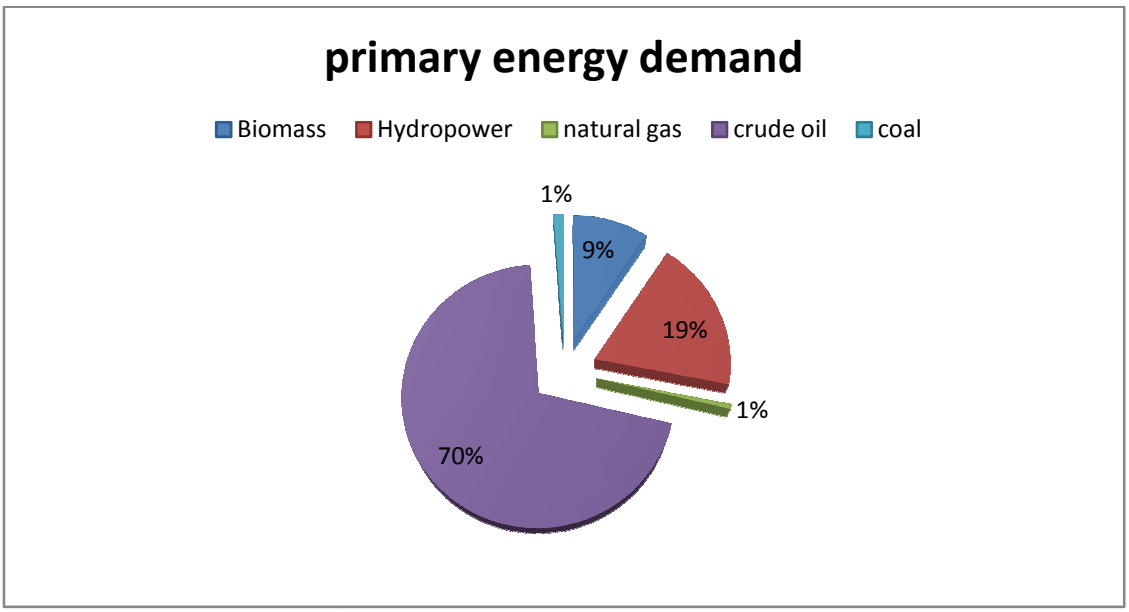


Image 9 Albanian Power Electric Power Production and Distribution (source: http://ebrdrenewables.com/sites/renew/countries/Albania/profile.aspx)

Energy Situation

Albania has a total primary energy demand of 105 PJ. The share of different energy sources is shown in the following graph.



Graph 2 Share in primary energy demand in Albania (source: ENERDATA s.a. - WORLD ENERGY DATABASE [2008])

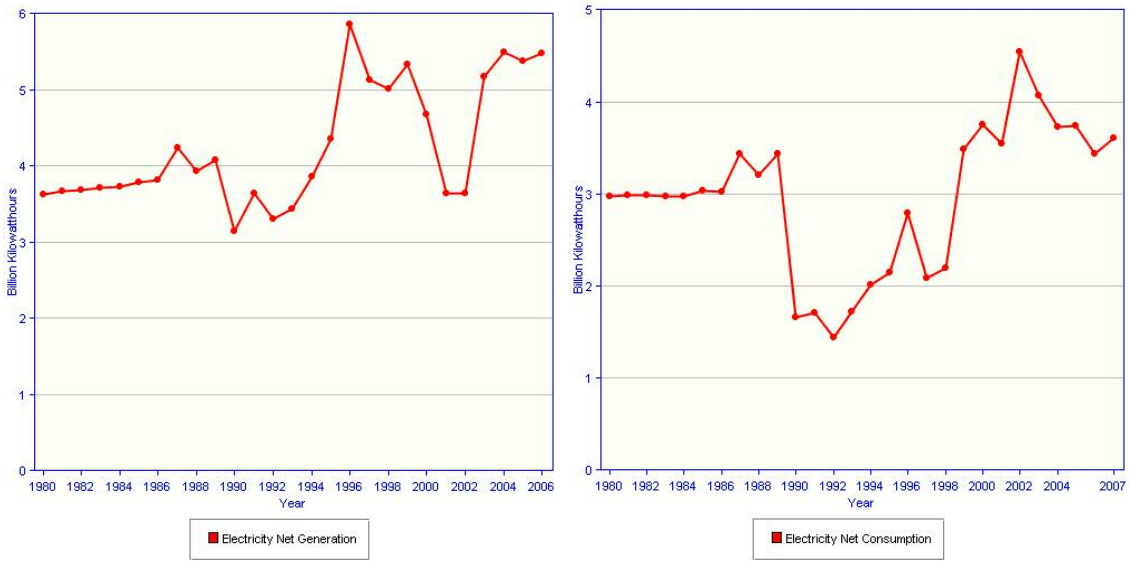
Albania was an energy exporting country until 1989. Due to the rising energy demand and the poor state of the existing power stations it has become a net electricity importer.

Energy Sectors

Electricity

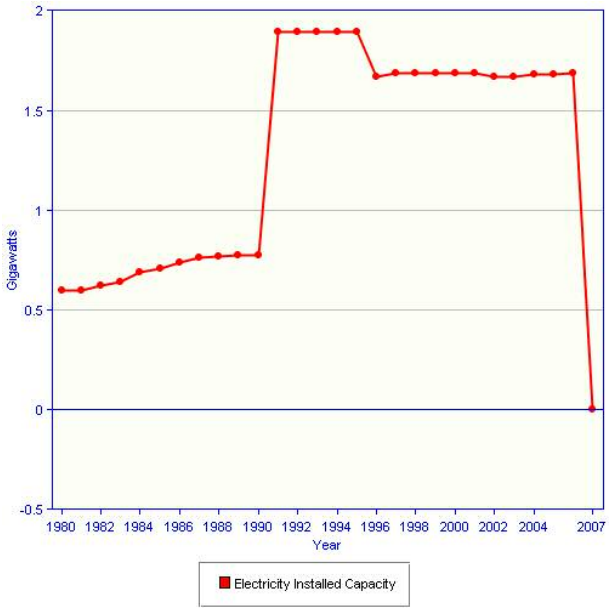
The Albanian regulatory framework attempts to promote competition in electrical energy production and supply. Up to now there is only one player in Albanian power sector which is KESH with an installed capacity of 1,660 MW
The final consumption of electric energy in 2007 was 3.44TWh.

In the next graph[8] the Albanian net electricity generation and the net electricity consumption are contrasted for the time period from 1980 to 2006



Graph 3 Net electricity production and consumption in Albania 1980 -2006

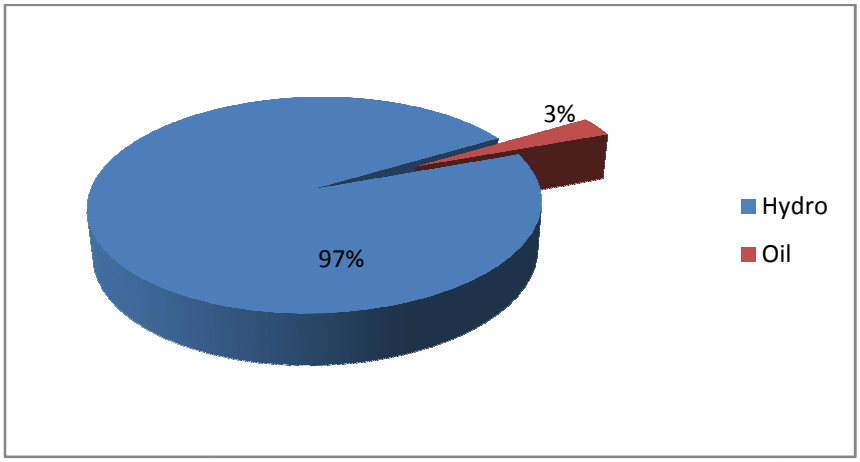
Next table shows the total installed electricity capacity[9] in Albania until 2006. (no data for 2007 availiable). Despite rising energy demand from the beginning 90´s, the installed capacity is almost unchanged since 1994.



Graph 4 Installed electricity capacity in Albania

[8] Source: eia - Energy Information Administration (http://tonto.eia.doe.gov/country/country_energy_data.cfm?fips=AL)
[9] Source: eia - Energy Information Administration (http://tonto.eia.doe.gov/country/country_energy_data.cfm?fips=AL)

The next graph shows the big importance of hydropower in Albania´s electricity production.



Graph 5 Share of primary Energy Carriers in Albania (source: ERE, 2007)

Oil and gas

The total Albanian demand of oil products in the year 2008 was 49,082 TJ, where 19,089 TJ came from Albanian oilfields and 49,993 TJ were imported.

From the approx. 345,000,000 barrel (approx. 47,050,000 t) of natural crude oil in the Balkan region Albania has the biggest share.

From the 78,4 Mrd m³ of natural gas in the Balkan region 850 Mio m³ are in Albania. The natural gas is exploited at the moment only for the Albanian demand. From the demand of 603 TJ in 2008 the full 100% came from Albanian sources.

Coal

The Albanian demand for coal in 2008 was 1,011 TJ. The Albanian coal production at the moment is approx. 125 TJ per year. The Albanian coal reserve is estimated with 710 Mio t of coal.

Wind Energy

Wind energy has been used for centuries mainly for pumping water and windmills. In the last 20 years in Albania some wind turbines with an installed capacity from a few kW up to 2 MW have been installed. It is considered that by 2020 4% of the country's electricity could be generated by wind power (some 400 GWh/yr).

In June 2009 the government of Albania approved the construction of Europe's potentially biggest 500 MW wind farm in the country's south.
The government has transferred more than 97 ha of land to Italy's Moncada Energy Group including a one kilometer buffer zone through which its Albanian subsidiary, Enpower Albania, aims to build the wind farm.
The decision to grant the land and the subsequent environmental permit were considered illegal under Albanian laws aimed at protecting natural reserves environmentalists reported.
The project will include the construction of a transmission line running from the port of Vlora in Albania to the Italian port of Brindisi. A 400 kV power cable, stretching 145 km under the Adriatic at a depth of over 900 meters, will allow electricity to be transmitted in either direction.
The interconnection line and the wind farm have an estimated cost of 1.25 Mrd Euros. Construction is expected to start in 2010. The environmentalists had warned that this project will create havoc on the unspoiled coastline while others believe it could be a breach of law.

Solar Energy

At the moment there are no considerable photovoltaic installations in Albania.
Albanian climate with hot and dry summers provides a good basis for photovoltaics.
The annual radiation varies between 3.2 kWh/m²/day in the north east part of Albania and 6 kWh/m²/day in the south.
Albanian ministry of Energy plans to install photovoltaic panels that will provide 2.6 PJ of electric energy by 2015.

Geothermal Energy

There are many thermal springs and wells in Albania, which represent a real potential for geothermal energy. To date in Albania, the geothermal sources have never been used as a source of energy
The thermal springs and wells in Albania are located in three areas:
1. Kruja geothermal area with the biggest geothermal resources in Albania.
2. Ardenica geothermal area with the biggest energy potential in the northern part of the region providing specific reserves between 38.5 and 39.6 GJ/m².
3. Peshkopia geothermal area with geothermal potential similar to Kruja region.

Biomass resources

Data on forest resources are based on inventories done every 10 years from the Forestry Directorate subordinated to the Ministry of Agriculture. Until now there is no technical use of biomass.
The next table shows the biomass potential in Albania:

Available Technical Energy Potential of Forests							
		Thin Branches	**Branches**	**Bark**	**Logs**	**Blockhead**	**Total**
Annual wood mass production	10^3 m³/year	18,482	47,019	10,104	2,262	10,671	88,538
Hardwood	10^3 m³/year	17,599	44,329	9,033	2,022	9,990	82,973
Evergreen	10^3 m³/year	884	2,690	1,071	240	680	5,565
Energy Potential	GWh/year	55.03	140	30.90	6.73	31.77	263.63
Technically feasible for energy production	10^3 m³/year	15,843	42,205	9,074	2,024	9,579	78,725
Technically feasible for energy potential	GWh/year	47.18	125.7	27.02	6.3	28.54	234.45
Economically justified energy production development in the next 10 years	GWh/year	63.28	169.05	36.31	8.1	38.37	315.1

Table 1 source:http://www.enercee.net/albania/energy-sources.html

Hydropower

The topographical and meteorological situations in Albania, especially in the north and east of Albania are perfectly set for producing electricity from hydropower.

The main rivers in Albania are Drini, Devol, Bistrica, Erceni, Mat, and Vjosa.

The large HPPs (Vau i Dejes, and Fierza) with a combined capacity of 1,350 MW on river Drini in the north compose 80% (!) of Albania's installed hydro power capacity. There are 83 small HPPs owned by KESH[10] rated 0.05 to 1.2 MW with a total installed capacity of 14 MW.
The annual hydro electricity generation capacity of the country has been approx. 3,300 – 3,500 GWh, reaching a peak of 5,800 GWh in 1996.
With an average rainfall of 1,500 mm/year (mainly in the winter month) and an average available head of about 600 m the country has an enormous potential for hydroelectric energy production, especially storage and pumped–storage hydropower plants.

According to the Albanian ministry of economics the total installed generating capacity in 2005 was 1,446 MW which lead to a production of 4.16 TWh. At the moment (2009) Albania is only utilizing 35% of its total technical feasible potential of 3 GW from which approx. 12 TWh of electricity could be produced.

The sum of realizable mid-size and large hydropower plants can be estimated with a capacity of 1.4 GW which would mean a production of about 6.77 TWh. In addition 145 MW of small hydro with an annual production of estimated 640 GWh are possible[11].

[10] Korporata Energjitike Shqiptare
[11] Source: Deutsche Gesellschaft für Technische Zusammenarbeit, Energiepolitische Rahmenbedingungen für Strommärkte und erneuerbare Energien, Teilstudie Albanien, 2004

The next table shows Albanian hydro power stations being built at the moment being under rehabilitation or expansion in near future:

Name	MW	status	contractor
Ashta Hydro	50.00	under construction	Verbund (AUT)
Banja Kesh	60.00	Planned	
Bistrica Kesh	28.60	Operating	
Bratile Hydro	70.00	under construction	Landsvirkjun (ISL)
Bushati	84.00	Planned	
Devoli River Albania Hydro (3 plants)	340.00	under construction	EVN (AUT) and Statkraft (NOR)
Fierza	510.24	Operating	
Fuzuli Hydropower Plant	25.00	Planned	
Kalivaci	120.00	Planned	
Komani	600.00	Operating	
Lanabregas	5.00	Operating	
Shkopeti	24.00	Operating	
Skavica Hydro	250.00	under construction	Tassara-Geotecna-Kinglor (ITA)
Smothinka	9.60	Operating	
Ulza	25.60	Operating	
Vau I Deja	258.00	Operating	

Table 2 Albanian HPP

[12]Especially on the Devoli River, where at the moment three hydropower plants with a total capacity of 340 MW are under construction is a very high potential for Austrian companies is given.

[12] See also EVN homepage (http://www.evn.at/Investoren/Pressemeldungen/Konzessionsvertrag-fur-drei-Grosswasserkraftwerke-.aspx)

The next picture shows the actual locations of the existing HPP and HPP –projects in Albania. This shows the present concentration of hydropower plants in the north and south of the country on the three main rivers Drin, Devol and Vjosa.

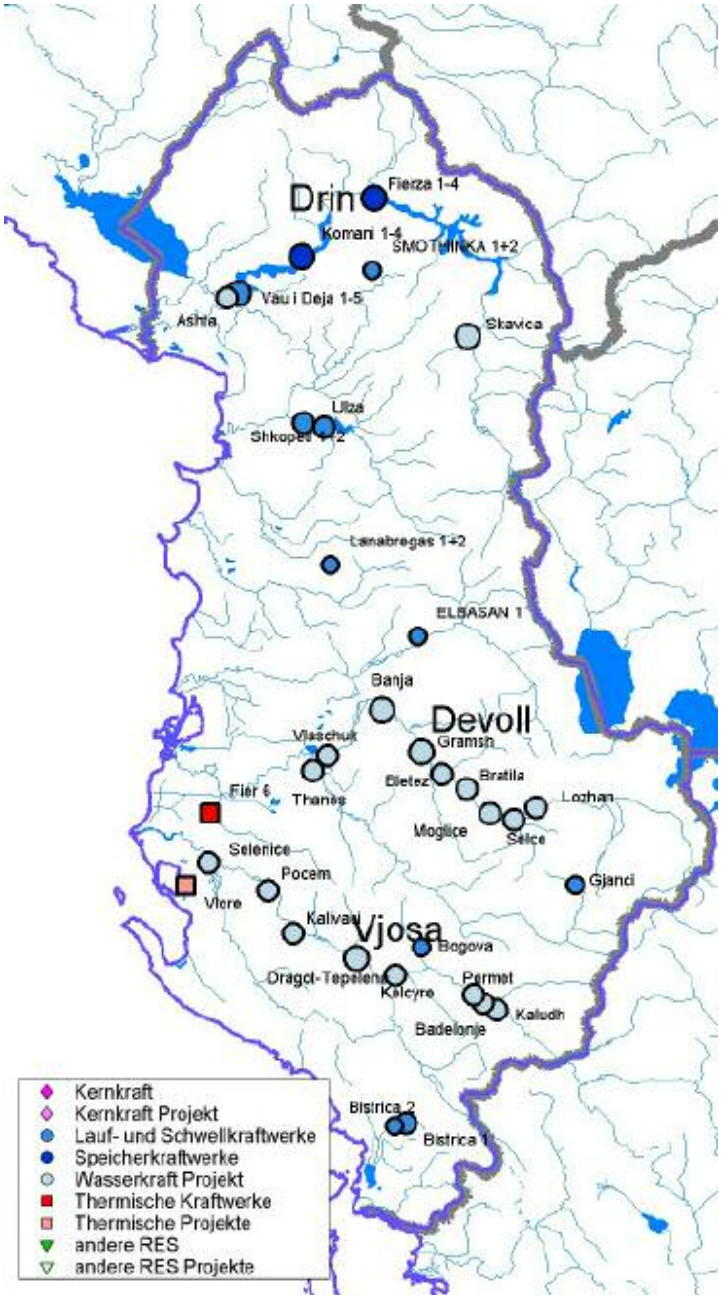


Image 10 Existing and planned HPP in Albania (source: Institute für Elektrizitätswirtschaft und Energieinovation, TU Graz for IEWT Vienna 2009)

In the year 2007 Albanian government started an initiative, based on this law to increase hydro power production to overcome the upcoming energy crisis. Due to the lack of money statewide, Albanian government or local companies are not able to finance large water power projects. This is the reason for a strong market penetration of European investors, most of them big energy suppliers from Austria, Norway and Slovenia. These investors built new medium and large sized HPPs in Albania. Privatization seems also to be the main driver behind small hydro rehabilitation and development.

Hydro Power Stations under construction:

Drini River

Ashta 1 /2

In October 2008, a 35-year BOT (=Built, Operate and Transfer) concession agreement for Ashta hydropower plants (48 MW) has been signed with a consortium of Verbund and EVN.

The Ashta 1 hydro power station will be equipped with 45 units of HydroMatrix turbines with a cumulated rated output of 19,7 MW and a rated discharge of 560 m^3/s using a rated gross head of 5m

The Ashta 2 hydro power station will also have 45 units of HydroMatrix axial flow turbines but with a rated output of 28,3 MW using a rated gross head of 7,53 m. The demand for hydraulic steel structures will include trashracks, bulkheads and stoplogs. For cleaning the trashracks a hydraulic type trashrack cleaning machine is foreseen.
For handling the HydroMatrix and the stoplogs two sets of gantry cranes, with a capacity of 20 t each will be used

The image on next page shows a system drawing for the powerhouse of Ashta 1 and 2 (courtesy of Verbund Austrian Hydropower – AHP)

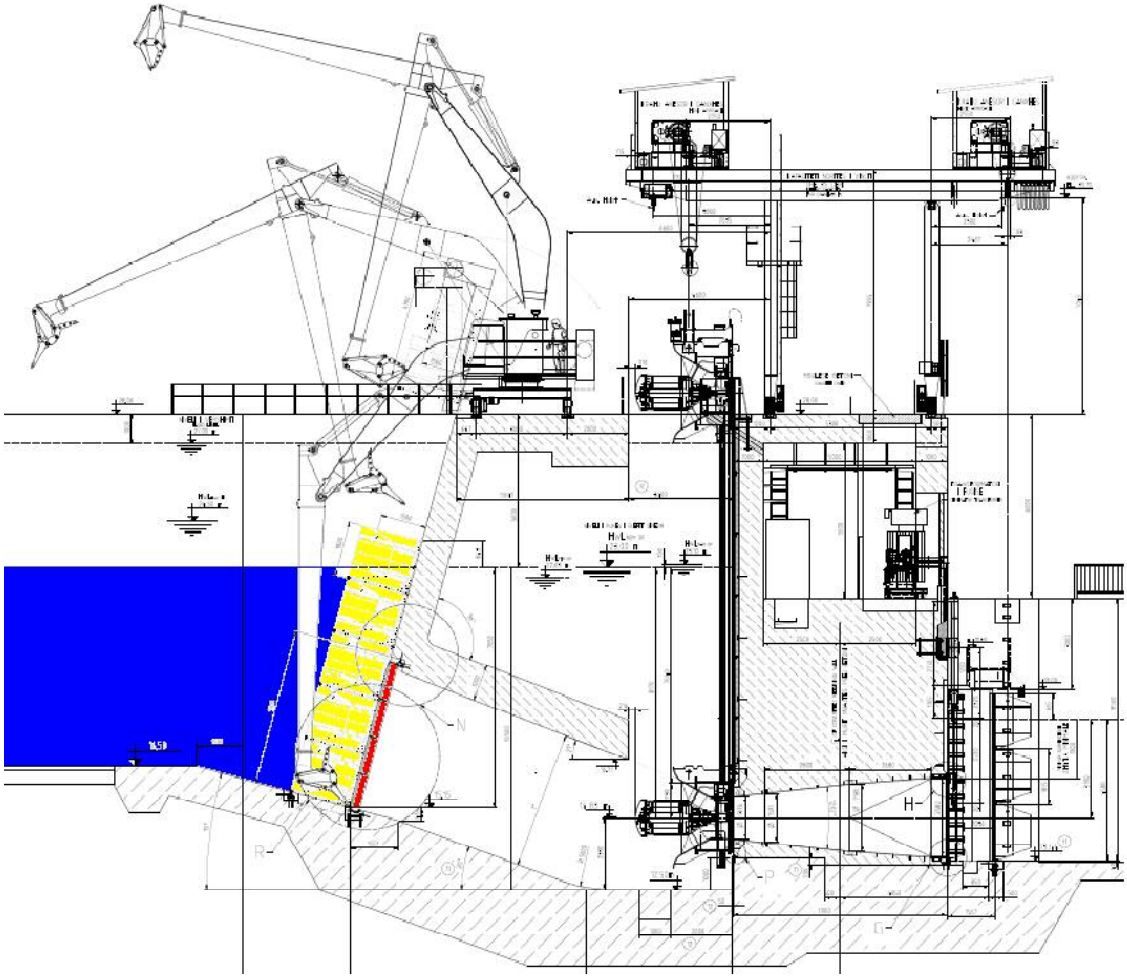


Image 11 System drawing of Ashta HPP (source: Verbund Austrian Hydropower – AHP tender documents)

All hydro mechanical equipment will be produced and delivered by Austrian companies.

The Albanian government has awarded a concession to the Italian group Tassara-Geotecna-Kinglor (TGK) to build the third largest hydro power plant in Albania.
The required investment is 500 Million Euro.
The plant, to be constructed on the Black Drin River, near the Skavica villages, is estimated to have a production capacity of 250 MW.
Plans for the Skavica project were first prepared in 1978, but was not implemented due to lack of funds. The annual production of electricity from this plant is expected to be approximately 1.800 GWh.[13]

[13] http://www.waterpowermagazine.com/story.asp?sectioncode=130&storyCode=2029161

Devol River

In January 2009 the Albanian government has approved a deal with Austria's EVN utility and Norway's Statkraft who will invest 950 Million Euro to build three storage power plants along the Devol River, a 280 km long river, which flows from the mountains in the west into the Adriatic Sea.
The Devol River is almost unused for hydro power production until now.
The three plants will have a combined capacity of 340 MW of power and generate 1.000 GWh of electricity annually to supply electricity to 300.000 households.

EVN[14] and Statkraft have signed a Joint Venture contract to build the power plants and the needed 60 km of tunnel system on 19 December 2008.
Time of realization will be from 2010 until 2019.

Bratile

The Icelandic national power company, Landsvirkjun, has been awarded a 25-year, build-own-operate (BOO) concession on the 70 MW Bratile project.
The company out-bid four others to secure the deal.
The new hydro power station will be constructed on the Devol river in the village of Bratile, joining 10 other hydro plants on the river
Albania is to see a new 75 Million Euro hydroelectric plant, according to officials from the country's Ministry of Industry and Energy.[15]

Curraj River

On 9 March 2009 Swiss energy group Alpiq Holding AG and Hydro Power Nord Albania won together the bid to build several hydro projects totaling 80 MW on Albania's Curraj River.
The Albania government announced tender results March 9, allowing Alpiq to open negotiations for a concession for the projects.
The Curraj River is situated in Northern Albania, in a region that is home to most of the country's hydroelectric power stations with a total capacity of 1700 MW. The region is rich in precipitation, and its hydrological conditions make it ideal for hydro power generation.
Decision for building and time schedule for completion of the power plants will be announced by Alpiq in late 2009.[16]

[14] Source: evn (http://www.evn.at/Investoren/Pressemeldungen/Konzessionsvertrag-fur-drei-Grosswasserkraftwerke-.aspx)
[15] http://www.waterpowermagazine.com/story.asp?sectioncode=130&storyCode=2028270
[16] www.hydronews.net/story_id=4953&worldregion_id=6

Different

Small hydro power plants could count for 700 GWh per year in already identified 41 locations.
Already 16 small hydropower plants projects have been awarded based on concession agreements that would add about 43 MW in installed capacity to the electricity system.

Vjosa River

The Vjosa River is the second largest river system in Albania. Its upper catchments include areas in Greece's northern mountains, with high precipitation.
Vjosa River is 272 km long and annual average inflow is about 195 m³ per second.
Until now, the hydropotential has not been exploited, except Kalivaci HPP.
The latest river development study (1990s) was established by Albanian Hydrogeotechnic Institute. The study defines 8 plants for the complete exploitation of the Vjosa River, with total capacity about 500 MW and production of 2.2 TWh.

		Capacity	Annual generation		
Nr	Name	MW	GWh	Catchment km²	Mean flow m³/s
1	Kaludh	75	280	2370	63
2	Badelonje	30	140	2780	74
3	Permet	25	115	2820	75
4	Kelcyre	35	165	3240	88
5	Dragot	130	580	5030	144
6	Kalivac	90	400		
6	Pocem	50	200	5570	159
7	Selenice	60	275	5710	163
	Sum	495	2155		

Table 3 Exploitation scheme of Vjosa River (source: Albanian ministry of economics and transport)

Hydropower stations ready for expansion and modernization:
The large hydro power stations on river Drini are equipped with hydro equipment nearly 40 years old and in bad condition. HPP Vau I, Deges, Koman and Fierze will be under modernization within the next 5 to 10 years.

As early as 2007 the government of Albania has announced to open an international tender for the construction of the Skavica HPP on the Drini River Cascade at the border to Macedonia, with an installed capacity 500 MW, a project worth approximately Euro 650 million.

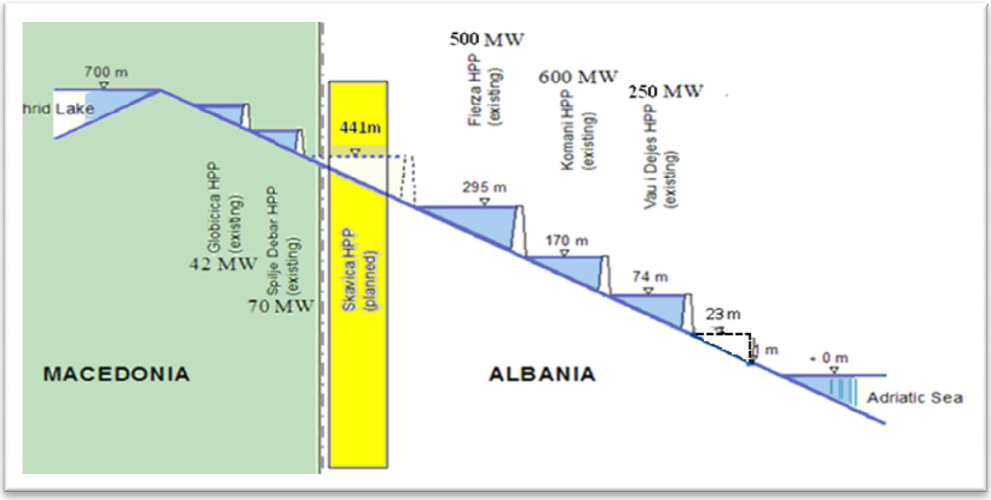


Image 12 Drini River Cascade (source: Albanian ministry of economics and transport)

The newly built reservoir for the hydro power plant Skavica will be entirely on Albanian territory and also allow the downstream of Skavica situated hydro power plants of Vau I Dejes, Fierza and Komani increase production by 200 – 300 GWh per year through the optimization of the water recourse use.
In December 2008, six companies from Italy, Austria, Norway, and Germany filed bids for a concessionary agreement to build and operate the Skavica HPP, considered the most important hydro project in Albania, with an installed capacity between 300 and 350 MW. The winner is expected to be announced in January, 2009 and total investment is expected to reach 850 million Euro.

Bosnia & Herzegovina

Image 13 Map of Bosnia & Herzegovina on the European Continent (source: different internet public domains)

Bosnia and Herzegovina is located in the central part of the Balkan Peninsula. North, west and south-west boundary lines divide BiH from the Republic of Croatia, and east and south boundary lines from the Federal Republic of Yugoslavia. The coastal line of Bosnia and Herzegovina lies upon the Adriatic Sea, around the town of Neum, and is about 21 km long. Bosnia and Herzegovina consists of four large geographic units.

After the end of the Balkan war in 1995 some arduous negotiations and a period of shuttle diplomacy by American emissaries, the American peace proposal was initialed by the presidents of Bosnia and Herzegovina, Croatia, and rump-Yugoslavia (Serbia and Montenegro) in Dayton, Ohio, on 21 November 1995 and signed by the involved parties in Paris on 14 December 1995.

The agreement confirmed the sovereignty and independence of Bosnia and Herzegovina in its internationally recognized borders. It established two autonomous political entities in the country, the Muslim–Croat Federation of Bosnia and Herzegovina and the Serb Republic. The first controls 51 percent and the second 49 percent of the total territory.

The central government has responsibility over foreign policy and trade, customs, immigration, monetary policy, international law enforcement, communications, transportation, and air traffic control. The accord established a bicameral legislature consisting of a 15-person upper chamber, a 42-person lower chamber, and a three-member collective presidency. Furthermore, it provided for a common constitutional court and a central bank.

The official currency is "Convertible Mark" (1 Euro = 1.95583 BAM fixed exchange rate to the Euro)[17]

The GDP (PPP) was in total 28.32 Mio US$ in 2007 and 6,200 US$ per capita. The following graph shows the Albanian GDP for the time from 1990 till 2004

Geographical Regions

Central Bosnia (12,920 km², population of 1,249,000) includes the mountainous area in the central part of Bosnia. This is the most developed part of the country that for a long time was a crossroad of various influences and interests of neighbouring Pannonian, Karst, and Mediterranean regions. "High Karst" and Pannonian Region of Bosnia and Herzegovina (11,842 km², population of 325,000) consists of the mountainous Karst area of west Bosnia and Herzegovina. This is the part of the country with the smallest population and is the least developed part - only 9% of its territory is cultivable and less than 30% of the entire population lives in the cities of this part. The Mediterranean region, Low Herzegovina (5,399 km², population of 296,000) is situated in the central-coastal region behind a mountain, and is the smallest of the four geographic regions of Bosnia and Herzegovina.

The population of Bosnia and Herzegovina is 4.4 Million; the capital is Sarajevo with a population of 300,000. The biggest cities in Bosnia and Herzegovina are Sarajevo, Banja Luka, Tuzla, Bijeljina, Zenica, Mostar, Doboj and Bihac.
Its area is 51,129 km². Highest point in Albania is mount Maglic (2,387m above sea) its lowest point is sea level.

[17] Source: CIA – The World Factbook

Legal Framework

The Dayton Agreement, which set an end to the three and a half year long war in Bosnia, was signed in Paris on 14 December 1995. Bosnia and Herzegovina's exterior border retained and a joint multi-ethnic and democratic government was created. This national government is based on proportional representation and its duties are conducting foreign, economic, and fiscal policy.

The Dayton Agreement also recognized a second tier of government, comprised of two entities – the one a joint Bosnian-Croatian Federation of Bosnia and Herzegovina (FBiH) and the second a Bosnian Serb Republika Srpska (RS) - each responsible for roughly one-half of Bosnia and Herzegovina's territory.

FBiH and RS governments are charged with overseeing internal functions. The Bosnian-Croatian Federation is further divided into 10 cantons. The Dayton Agreement established the Office of the High Representative to oversee the implementation of the civilian aspects of the agreement.

The unbundling of the three established energy suppliers into

1. Energy Transmission
2. Energy Distribution and
3. Energy Production

is in accordance with the recognized entities and is coordinated at the state-wide level by the Ministry of Foreign Trade and Economic Relations.

Until 2009 there is no Energy Strategy for Bosnia & Herzegovina; only an interim development strategy for the energy sector has been implemented in 2004 for the time from 2004 until 2007.
The goals for the reform in the energy sector are:

- to join the international market through a single BiH market of electric power and gas
- to enhance cost-effectiveness and rational use of energy sources and improve energy efficiency
- to introduce competition and transparency in the energy market
- to ensure the protection of the environment in accordance with national and international standards
- to protect interests of the system users
- to increase the use of renewable energy sources
- to meet the conditions of the European Energy Charter Agreement, as well as other international contracts and agreements.

In October 2005 the Republic of Bosnia and Herzegovina has signed the treaty for establishment of an European Energy Community in Athens, Greece.

Energy market players

Elektroprivreda BiH[18]

Public Enterprise Elektroprivreda Bosne i Hercegovine – Sarajevo (hereinafter called as Elektroprivreda BiH) is a public utility for generation, distribution and supply of electricity. It is the largest energy company in Bosnia and Herzegovina according to capital value and the installed capacities, total generation and sales of electricity as well as number of customers. Regarding ownership structure Elektroprivreda BiH is Joint Stock Company, 10% of shares belong to privatization investment funds and to small shareholders, and 90% of shares remained in the Federation BiH ownership.

Elektroprivreda BiH has shareholders capital of 2.15 billion BAM, disposes with installed generation capacities of 1,682 MW and it serves more than 675 thousand of customers in the seven cantons within the Federation BiH.

In 2007 Elektroprivreda BiH operated with distribution network of voltage 35, 20, 10 and 0.4 kV in total length of 31,757 km, with 6,880 transformer stations (35/x, 10(20)/0,4 kV) with total installed capacity of 2,820 MW.

In 2007 generation of electricity amounted 6,544 GWh. From its electricity sales and other activities, Elektroprivreda BiH realized total revenue of 765.3 million and gained profit of 11,5 million BAM.

[18] Source: http://www.elektroprivreda.ba

Elektroprivreda Hrvatske Zajednice Herceg-Bosna

Elektroprivreda Hrvatske Zajednice Herceg-Bosna is the electricity company based in Mostar and serving the surrounding area of intermediate Bosnia with approx. 180,000 customers[19]

Elektroprivreda Hrvatske Zajednice Herceg-Bosna operates only hydro power plants with an installed capacity of total 900 MW which supplied 1,175 GWh in 2008. The supplied area has a total demand of approx. 2,900 GWh what makes buying of power from outside necessary.
The company is divided into seven subdepartments:

1. generation,
2. transmission,
3. distribution,
4. research and development,
5. system control and operation,
6. finance and legal and finally
7. personnel and administrative.

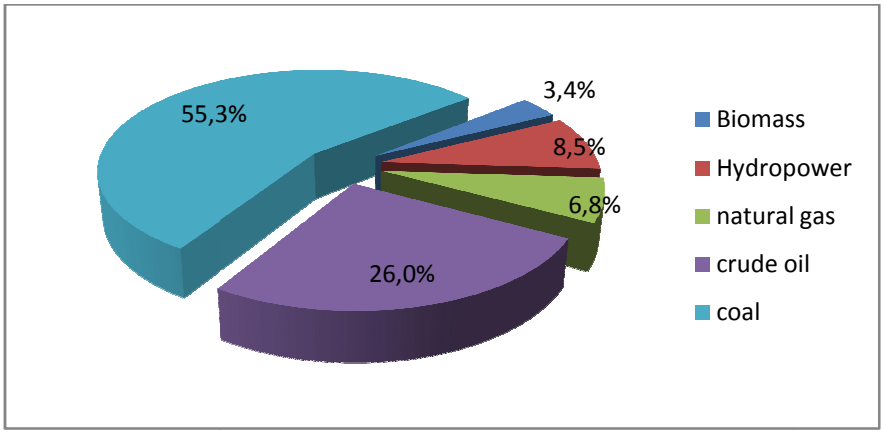
Elektroprivreda Republike Srpske

Elektroprivreda Republike Srpske is based in Trebinje and serves about 400,000 customers in the Republik of Serbia with a demand of approx. 2,000 GWh per year. The company operates five hydro power plants 5 hydro plants Bocac, Trebinje and Visegrad with a total installed capacity of 1,424 MW and 3 thermal power plants Gacko and Ugljevik with a total installed capacity of 600 MW. From this installations a total of 4,400 GWh is produced which enables Elektroprivreda Republike Srpske to sell 2,400 GWh per year.
All power stations in the company are operated independently as separate companies with own responsibility for production. There is also an independent distribution and transmission organization within the company.

[19] In year 2007

Energy Situation

BiH has a total primary energy demand of 211 PJ. The share of different energy sources is shown in the next graph:



Graph 6 Share in primary energy demand in BiH (source: ENERDATA s.a. - WORLD ENERGY DATABASE [2008])

BiH Electro-Energetic System[20]

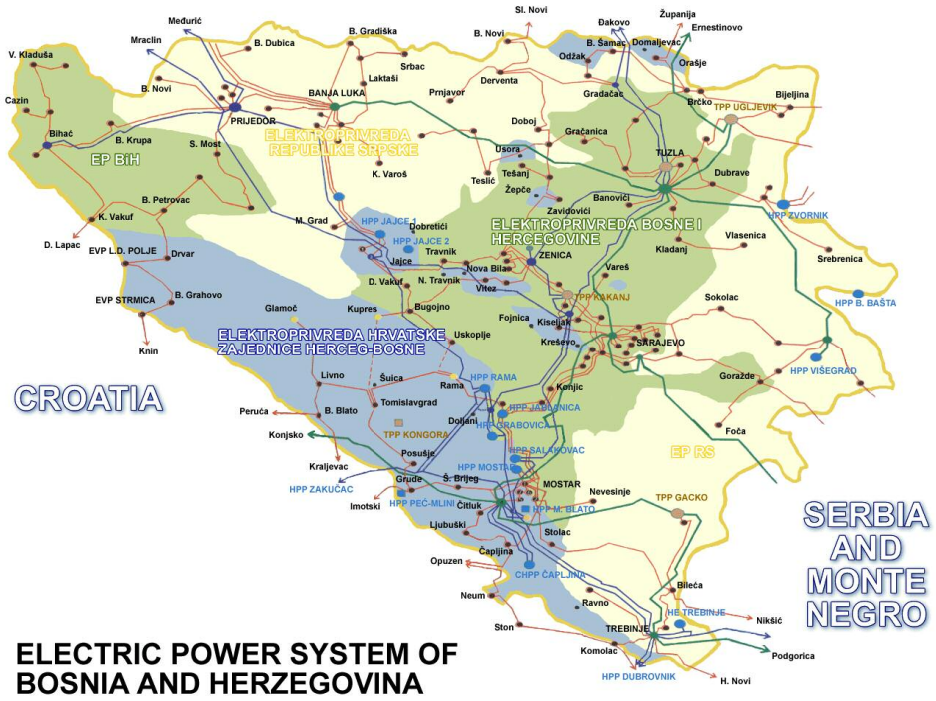


Image 14 BiH Electric Power System (source: source: SEE - energy, http://www.seenergy.org/index.php?/countries&stat=2&type=3&col=2125)

[20] Green and blue area represents the Federation of Bosnia and Herzegovina, the green area represents the Republic of Serbia

Energy Sectors[21]

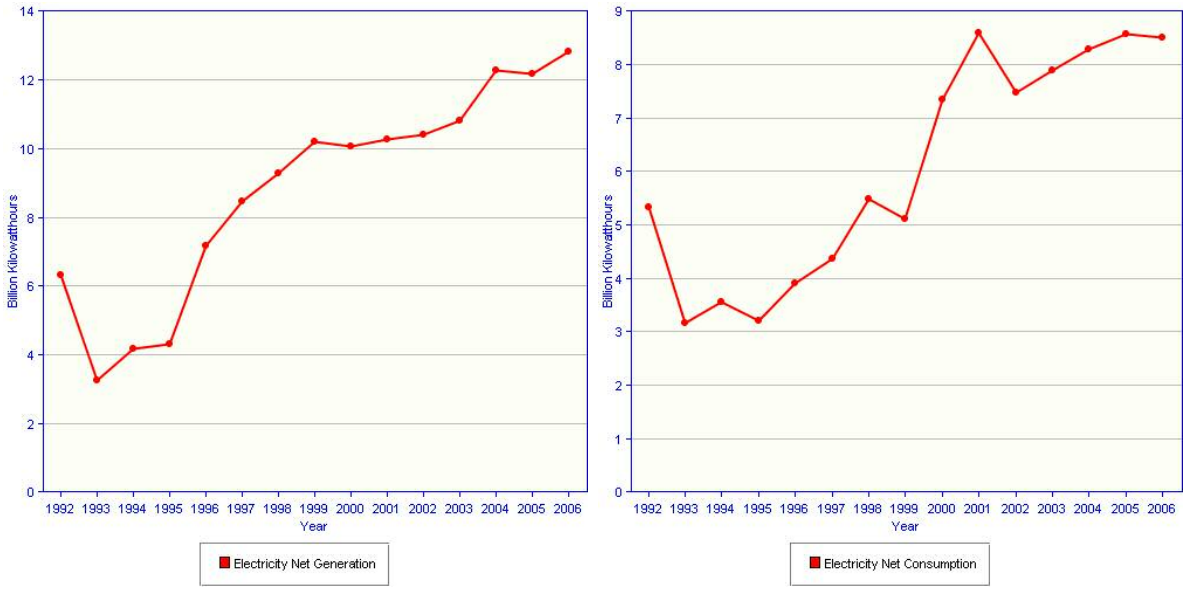
Electricity

Existing electric generating infrastructure is entirely composed of thermal and hydroelectric generating stations. Much of the generation and transmission infrastructure was destroyed or severely damaged during the ethnic conflicts. Additionally, the transmission system sustained significant damage during the war, and is still in the process of rebuilding.

The electricity system in Bosnia and Herzegovina is facing considerable challenges. Large investments are required to rehabilitate, modernize and expand the electricity system to meet growing demand and to maximize trading opportunities. Without these investments, the supply of competitive electricity to the people of Bosnia and Herzegovina will be in danger.

The total electricity generation in BiH in the year 2006 was 12.84 TWh and the consumption in the same year totaled 8.50 TWh.

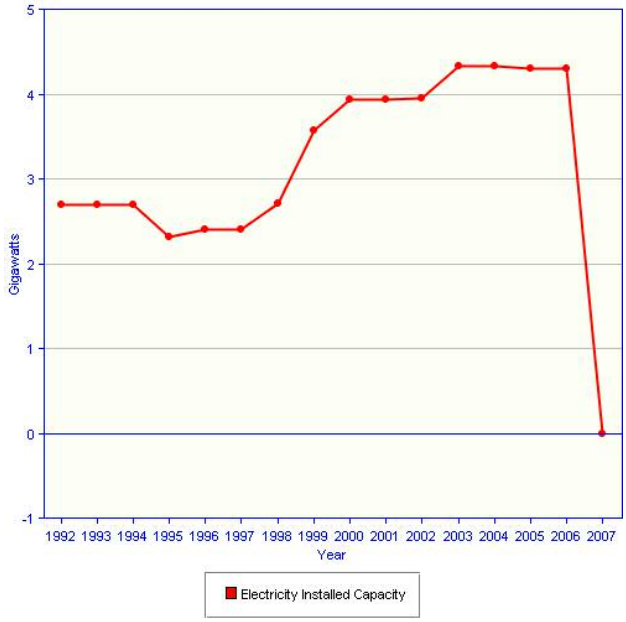
BiH is a electricity exporting country. The trend of production and consumption of electricity is shown in the next graph[22].



Graph 7 Net electricity production and consumption in BiH 1980 -2006

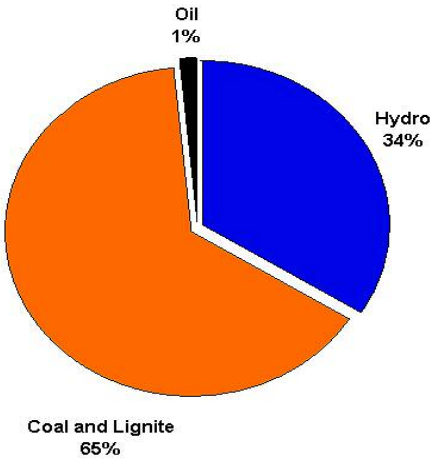
[21] Source: http://www.seenergy.org/index.php?/countries&stat=2&type=3&col=2125
[22] Source eia (http://tonto.eia.doe.gov/country/country_energy_data.cfm?fips=BK)

Next table shows the total installed electricity capacity[23] in BiH until 2006. (no data for 2007 availiable). Despite rising energy demand from the beginning 90´s, the installed capacity is almost unchanged since 1994.



Graph 8 Installed electricity capacity in Bosnia & Herzegovina

The next graph[24] shows the electricity production by energy carriers in Bosnia & Herzegovina in 2007. HPPs supplied 35% and TPPs supplied 65% of capacity for electricity production.



Graph 9 Electricity production by source in 2007

[23] Source: eia (http://tonto.eia.doe.gov/country/country_energy_data.cfm?fips=BK)
[24] Source: Austrian Energy Agency – enerCEE.net (http://www.enercee.net/fileadmin/enercee/images/Bosnia/el_pro_bih.gif)

Oil and gas

There are no proved oil and gas reserves known in Bosnia and Herzegovina. Therefore 100% of its oil and gas consumption has to be imported. BiH imports oil and gas via a pipeline from Russia. In the year 2005 the primary energy demand (= import) of gas was 15,167 TJ, the primary energy demand (= import) of oil and oil products was 55,230 TJ.
For electric energy production 1,993 TJ of oil products were used. In final consumption the share of oil products was 48,000 TJ and for gas it was 8,347 TJ.

Coal

The primary energy demand for coal in BiH in the year 2005 was 118,802 TJ, the own production was 114,421 TJ[25].
For production of electric energy 89,218 TJ were used, the remaining share of 27,434 TJ was used for final consumption in industry and households.

Wind Energy

In a preliminary study carried out on behalf of the GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit) it was established that there is an economic potential of approximately 600 MW that could be developed by 2010, on the assumption that an appropriate incentive system to build wind power installations is set up.

Biomass

There is no reliable data on the exploitation of biomass in Bosnia and Herzegovina. It can be assumed, however, and there is considerable potential for the use of biomass for energy generation in the forestry sector (roughly 50% of the land area of Bosnia and Herzegovina is wooded) and in agriculture. According to a study conducted by Innotech HT GmbH, Berlin, in 2003 on behalf of the GTZ, there is an unexploited potential of approx. 1 million m³/yr of residual wood, wood waste etc. which could be used to provide heat to 130,000 residences or 300,000 inhabitants.

[25] The difference of 4,380 TJ came from national stock variations

One field where wood is already used in Bosnia and Herzegovina is where wood waste is converted into electrical energy in steam power plants, such as in the state-owned Krivaja factory in Zavidovici, manufacturing furniture and timber houses. With a maximum thermal output of 15 MW, peak electricity outputs of 4.5 MW are generated for the factory's on-site power needs. There are also plans with the local authority for a group heating scheme in locality, but because of a lack of funding it has so far not been possible to put these into practice.
Near Sarajevo a landfill gas plant with a 350 kW generator has been built with Austrian support; its capacity is due to be doubled in the near future. The electricity is fed into the urban grid.

Solar Energy

Although there is almost no significant use of solar energy, Bosnia and Herzegovina can be counted among the more favorable countries in Europe with respect of solar radiation.
Solar irradiation in Bosnia – Herzegovina is 1,240 kWh/m²/year in the north of the country and up to 1,600 kWh/m²/year in the south
Solar energy for warm water preparation in households is commonly used.

Geothermal Energy

The geothermal potential of Bosnia Herzegovina is 33 MW.
The three locations where thermal energy is exploited are Bosanski Samac (85°C), Kakanj (54°C), and Sarajevo (58°C). The figures show, that the temperature is too low for electricity generation.

Hydropower

The largest rivers in Bosnia and Herzegovina are the river Sava (forms also the northern border to Croatia), Neretva (largest river in BiH). Una, Sana, Bosna and the Drina in the east, which forms a natural border to Serbia. The large and medium hydropower plants are concentrated on the rivers Drina, Sava and Neretva.

In the next picture the existing and planned HPPs in Bosnia and Herzegovina are shown:

Name	MW	status	contractor
Bočac	110.00	operating	
Čapljina	420.00	operating	
Buk Bijela	3 x 150	planned	
Cijevna 1 - 6	43.00	tendering	Technor
Doboj	4.50	tendering	Technor
Drina River EBH Hydro	300.00	planned	
Dubrovnik	105.00	operating	
Grabovica	114.00	operating	
HE Peć-Mlini	30.00	operating	
Jablanica	155.00	operating	
Jajce I	60.00	operating	
Jajce II	30.00	operating	
Krupa	48.50	in construction	
Mostar	75.00	operating	
Pale, Bistrica and Janjina	50.00	planned	
Rama	160.00	operating	
Salakovac	210.00	operating	
Srbinje	55.50	operating	
Trebinje I	180.00	operating	
Trebinje II	8.00	operating	
Ustikolina	63.00	operating	
Višegrad	315.00	operating	
Vranduk	21.00	operating	
Vrbas River Hydro	75.00	tendering	Statkraft
Vrito	42.00	operating	

Table 4 BiH Hydro Power Plants

In Bosnia and Herzegovina the total potential of hydropower is estimated at approx. 8,000 MW (68 TWh), the technical feasible potential at 6,800 MW (24 TWh) and the economical feasible potential 5,600 MW.[26]

From the economical feasible potential for medium and large HPPs of 5,600 MW at present 2,630 MW are used which counts for 34% or 9.1 TWh of the electric energy production per year.
The estimated potential for small hydropower is 31 MW or 2.5 TWh.

Hydro Power Stations under construction:

Drina River

Bosnia's Elektroprivreda BiH[27] is planning to build two hydro-power plants on the Drina river on the rim of Serbia. This will be a joint project between Elektroprivreda BiH and Serbian counterpart Elektroprivreda Serbia. The start of the project is expected by end of 2009.
Total capacity of both hydro power plants will be approx 300 MW.

Buk Bijela

The Buk Bijela hydro power plant should be one of Bosnia and Herzegovina's largest hydro power plants, if built, having an installed electric capacity of 450 MW. However, the project has been under harsh scrutiny of local and national communities and various NGO's from Bosnia and Herzegovina, Montenegro and abroad, due which it is postponed and possibly will be eventually canceled for destroying the magnificent canyon of the Tara river.

Image 15 planned HPP Buk Bijela (source: www.bmu.de)

[26] Source: P. M. Gvero, University of Baja Luka, The Potential of Renewable Energy Sources in Bosnia and Herzegovina, Climate Change in South-Eastern European Countries: Causes, Impacts, Solutions, Graz, Austria, 2007
Austria, 2007
[27] Information from Elektroprivreda BiH General Manager Amer Jerlagic

Srbinje/Foca

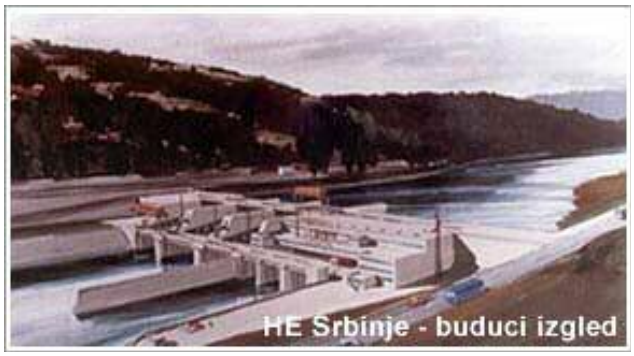


Image 16 planned HPP Srbinje (source: www.bmu.de)

The Srbinje hydro power plant will have (- if built) a capacity of 56 MW. This hydro power plant is intended as compensating reservoir on the river Drina for the HPP Buk Bijela. There are several objections raised from local and national communities against the project so it is postponed at the moment and possibly will be canceled.

Vrbas River

In January 2008 the Norwegian company Statkraft has signed a contract to develop and construct four hydro power plants on the lower Vrbas River with a total installed capacity of 75 MW and an annually electricity production of 450 GWh.
The budget of this project is approx 100 Mio Euro.

Hydropower stations ready for building, expansion and modernization:

Bosna River

Cijevna 1-6 and Doboj

The Bosna River has a total hydro power potential of approx. 364 GWH per year. The Norwegian company Technor Energy AS is financing a BOP project for designing and erection of 7 hydro power plants on the River Bosna between Doboj and Modrica. For this project a feasibility study was done by South East Europe Consultants Ltd., S.E.E.C., Belgrade and the Institute of Civil Engineering (IG), Banja Luka

The hydro power project turnkey project includes the engineering, procurement and construction of a total of seven hydro power stations and will be executed in three phases:

- Phase 1 includes the erection of three power plants Cijevna 1, 2 and 4
- Phase 2 includes HPP Cijevna 5 and 6 and HPP Doboj
- Phase 3 consists of the HPP Cijevna 3[28]

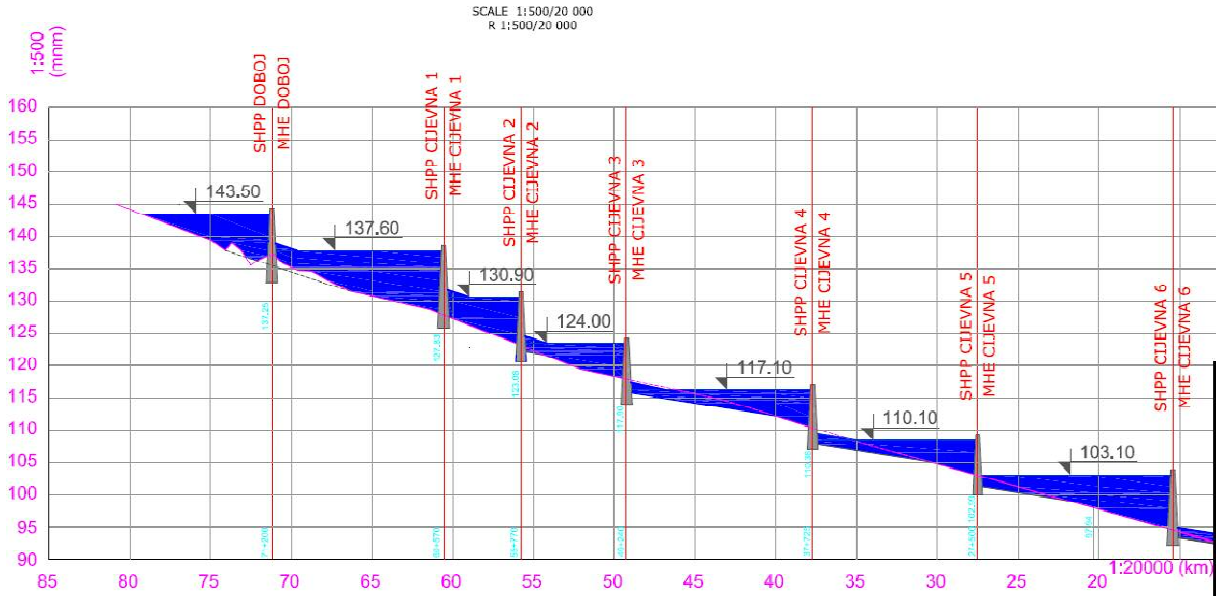


Image 17 Longitudinal section of river Bosna between Doboj and Modrica (source: Technor SA feasibility study)

An international invitation to tenders has already been published (June 2009) and nine companies specialized in hydro power plant construction have collected the tender dossier to bid. The acceptance date for the winning bid is expected by end of January 2010. The construction of the power plants will take three years and each power plant will generate some 70 GWh of electricity annually, with an average rated power of 14 MW.

All six hydro power plants are run-of-the-river projects and the investment for each is estimated at 40 Mio Euro. For the construction work the contractor will hire workforce from Bosnia and Herzegovina. Hydro power plants will be surrounded with jogging paths, promenades and tree-lined avenues. Once the construction is completed, the riverside will be protected from large alluvial deposits, risk of devastating floods will decrease and it will be easier to monitor the exploitation of gravel.

[28] The concessions for HPPs Cijevna 1, 2, and 4 to 6

Tender for HPP Doboj and Cijevna 1 – 6 include hydro mechanical equipment for 7x 2 turbines (Pit – option Bulb) in 7 powerhouses. From the hydraulic steel structure side the tender mentions 7 x 2 emergency draft tube gates, 2 sets of turbine inlet stop logs, 7 x 2 trash rakes, 7 trash rake cleaning machines and 7 portal cranes for stoplog handling in the intake. Also included are 7 bridge cranes with a capacity of 50 t for the powerhouse.

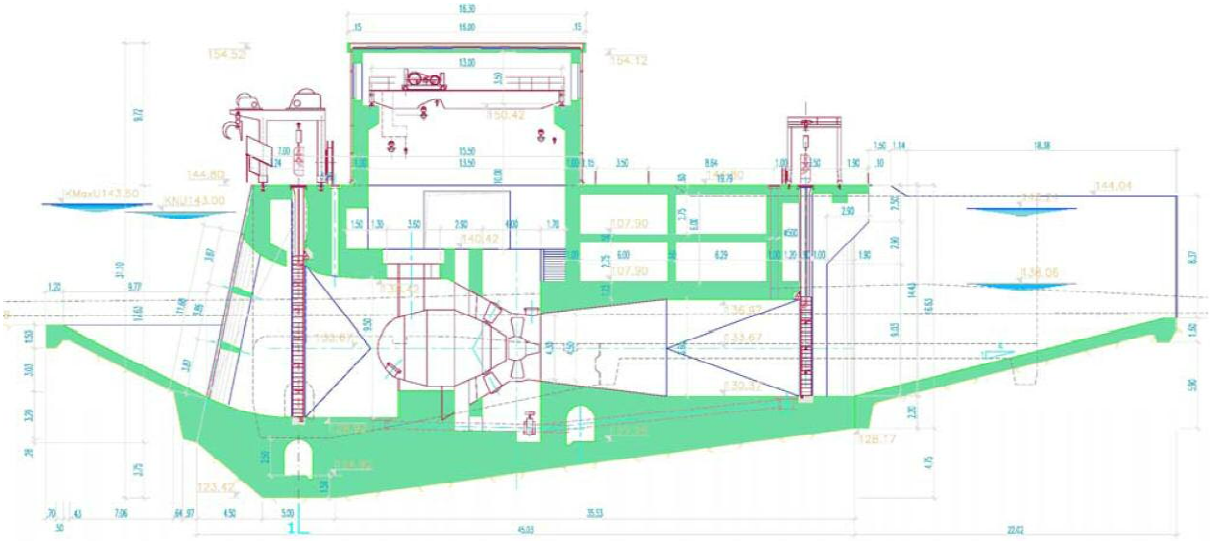


Image 18 preliminary drawing for the HPP Doboj - powerhouse (source: Technor SA feasibility study)

The tender for the seven spillways includes from the hydraulic steel structure side the engineering, construction and putting into operation of 7 x 6 radial gates[29] including hydraulic system, 2 sets of upstream maintenance stoplogs and 2 sets of downstream maintenance stoplogs. For manipulating the stoplogs portal crane are tendered upstream as well as downstream each spillway.

Each of the powerplants will be equipped with a trash rack cleaning system.

[29] 6 gates for every spillway where two radial gates out of the six are equipped with additional flaps.

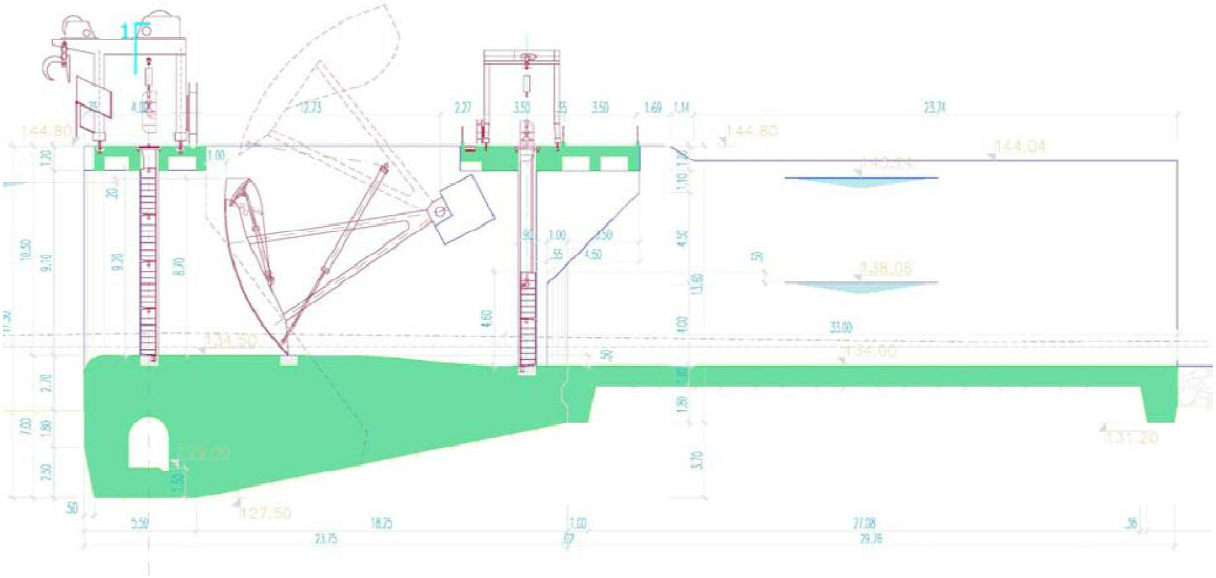


Image 19 preliminary drawing for the HPP Doboj - spillway (source: Technor SA feasibility study)

The technical data for the HPP are as follows:

Rated power of turbines HPP Cijevna 1 – 6	2 x 7.0 MW
Rated power of turbines HPP Doboj	2 x 5.0 MW
Installed discharge for HPP Cijevna 1 – 6	2 x 125 m³/s
Installed discharge for HPP Doboj	2 x 110 m³/s

Vranduk HPP

The Bosnia and Herzegovina's power utility Elektroprivreda BiH plans to build the Vranduk hydro power plant in the second half of 2009. The investment is estimated at 50 Mio Euro, 67 % of which would be covered by loans. The rest of the finance will be provided by Elektroprivreda.
Preliminary activities for the Vranduk HPP on the river Bosna, a few hundred meters downstream from the old town of Vranduk, are underway as planned.
The projected annual production of the power plant is 100 Mio kWh of electricity with a rated power of 21 MW-
Elektroprivreda first needs to complete an environmental impact assessment and protect the old town of Vranduk before tendering the project.

Mostarsko Blato

The Mostarsko Blato hydro power plant is on the river Listica, in the municipality of Mostar. It is built by Public Company Elektroprivreda HZHB and will be in operation by the year 2010.
The annual generation from this 61 MW hydro power plant will be 167 GWh.
The total investments are approx. 75 Mio Euro. The hydro mechanical equipment is delivered and set into operation by Montavar metalna nova, Slovenia.

On 29 September 2006[30] the Government of Federation Bosnia and Herzegovina announced plans to build 11 power plants in BiH including seven hydro-power plants (Ustikolina with capacity of 3x22 MW, Vranduk 21 MW, Rmanj Monastir 2x35 MW, Vrilo 42 MW, Glavatičevo 3x9,5 MW, Bjelimići 2x50 MW, and Bjelimići 2x300 MW), two thermal power plants (Tuzla block 7.37 MW and Kakanj 230 MW), and two coal mines and thermal power plants (Bugojno 2x300 MW i Kongoro 2x275 MW).

The government also decided to award a contract to Elektroprivreda BiH for the construction of power plants in Ustikolina, Vranduk, Rmanj Monastir, Tuzla, Kakanj, and Bugojno, and to Elektroprivreda Hrvatske Zajednice Herceg-Bosna for the construction of power plants in Vrilo and Kongoro.

The total value of the investment in the construction of 11 power plants is estimated at EUR 2,500 million and 50,000 workers will be involved in construction works, while 4,000 to 5,000 jobs will be created after the construction.

[30] Source: www.DerStandard.at/fs/2606738

Hydropower stations ready for expansion and modernization:

River Neretva

Jablanica[31]

The first phase of the rehabilitation of the Jablanica Hydro Power Station will be done in coordination with the World Bank.

Image 20 Jablanice HPP (source: www.elektroprivreda.ba)

The rehabilitation of the hydro mechanical and electrical equipment will start with unit 4 and includes: one Francis runner in CrNi 13/4 stainless steel with pertaining coupling elements, new runner is designed for up to 20 % overload, rehabilitation of the turbine mechanical parts, one complete Turbine Governing system, with all accessories and adaptation to the existing turbine device, incl. model tests, design, supervision of installation and commissioning.

Visegrad[32]

HPP Visegrad is a 1982 built HPP which was heavily damaged during the NATO airstrikes against Serbia in the year 1999. The pumped storage hydro power station with a rated power of 315 MW belongs to Elektroprivreda Republike Srpske and is ready for rehabilitation.

[31] Andritz Hydro (references Service & Rehab) see: www.andritz.com
[32] Source: "HIDROELEKTRANE NA DRINI", a.d. VIŠEGRAD (http://www.henadrini.com/old_site/index.htm)

The biggest problem is the leaking out of water from the reservoir under the dam corpse. Leaking out arose from 1.4 m^3/s (1991) to 12 m^33/s (2004) and to 18m^3/s

in 2008. This is a still a serious problem that needs to be solved urgently as for economical as well for technical reasons

Macedonia

Image 21 Map of FYR Macedonia on the European Continent (source: different internet public domains)

The former Yugoslav Republic of Macedonia as a federal unit of the Yugoslav Federation was constituted on August 2, 1944. After the multi-party elections held in November 1990, and the referendum on September 8, 1991, the former Yugoslav Republic of Macedonia became an independent country. On April 8, 1993 it became the 181st member of the United Nations (UN) and after that member of the International Monetary Fund (IMF), the International Bank for Reconstruction and Development (IBRD), the International Development Association (IDA), the International Finance Corporation (IFC), etc.

In 1991, the former Yugoslav Republic of Macedonia adopted its constitution, and established a multiparty system, civil society and a free market economy. Thus, the former Yugoslav Republic of Macedonia has begun the process of transition in its political and economic systems.

Along with the implementation of a macroeconomic stabilization program, the Government has shown a strong commitment to structural transformation and has implemented an extensive reform agenda since 1994, including a program for privatization.

In October 2005 the Republic of Macedonia has signed the treaty for establishment of an European Energy Community in Athens, Greece.
In December 2005, Macedonia was granted the status of candidate for membership in the European Union.

Situated in the Balkan Peninsula, the former Yugoslav Republic of Macedonia is a small, landlocked country, located on an area of 25,713 km^2

Macedonia has borders with four countries: the Federal Republic of Yugoslavia to the north, Bulgaria to the east, Greece to the south and Albania to the west.

The former Yugoslav Republic of Macedonia is a largely mountainous country with 80 % of high plains, plateaus and mountains. There are 16 mountain peaks higher than 2000 m. There are three tectonic lakes in the country: Ohridsko, Prespansko and Dojransko, and in addition, 15 artificial and 25 glacial lakes, dolling the country.

The major rivers that run through its territory are: Vardar, Crni Drim and Strumica.

Two valleys, Vardar and Strumica, have temperate Mediterranean climate and the rest of the country has a moderate continental climate, with warm dry summers and cold wet winters.

The capital city – Skopje, is situated at 245 m above sea level, and has over 500,000 citizens representing 25% of the total population

The population of the country is 2.1 million people, out of which 67% are Macedonians, 23% – Albanians and the rest – Turks, Serbs, Rhomas and Vlachs. The long-term population growth rate is about 0.9% a year

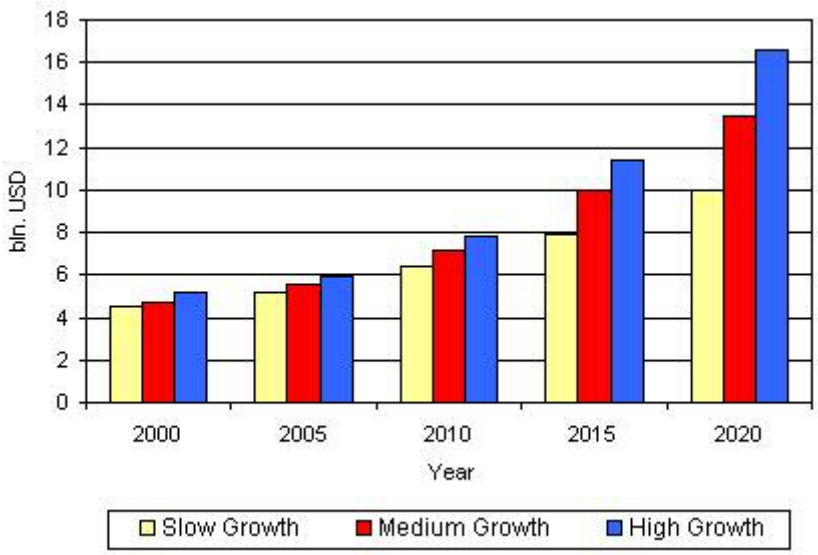
Economic Situation and Development

Ever since gaining the independence, the former Yugoslav Republic of Macedonia has systematically been transforming its economic policy from a socialist economy to a market oriented one.
The process of transformation, still in progress, has involved widespread changes in the country's institutional and legislative framework. In making the transition to a market economy, the country has experienced major disruptions in production, employment and social welfare

Recently, the economy has stabilized: in 2008 inflation was 2.3%, and the foreign dept was 1,762.2 Mio Euro in 2006.

The national currency, the Macedonian Denar (MKD), has been fixed to the German Mark since 1992, with one adjustment of 15% in July 1997. 1 Euro = 61.18 MKD[33]. Most prices in the country are determined freely. At present, price controls cover mainly public utilities.

The next graph shows the GDP forecast scenarios for the time until 2020



Graph 10 GDP forecast for Macedonia (source: World Bank)

Legal Framework[34]

Energy Policy of Macedonia

The mid-term goal is to harmonize Macedonia´s energy and environmental policies with those of the European Union. Since the end of the year 2005 Macedonia has the status of a candidate for membership of the European Union.

Already in October 2005 Macedonia signed the treaty for the establishment of a European Energy Community

[33] Source Macedonian National Bank

[34] Source: Ministry of Economy of the Republic of Macedonia (www.economy.goc.mk)

Energy Efficiency Strategy[35]

In the year 2004, the government adopted the "Energy Efficiency Strategy until 2020" which provides guidance for the energy efficiency policy in the Republic of Macedonia. The Energy Efficiency Strategy until 2020 is focused on the implementation of technologies for efficient energy use.

As reasons for the slow implementation of energy efficiency as well as renewable energy projects, the Energy Regulatory Commission names lack of information, awareness and confidence in the industry sector as well as the government agencies and the population, a lack of institutions to develop these projects, plan and monitor them, further the lack of institutional framework for renewable energy projects and also a lack of capital and absence of mechanisms for favorable long-term credits.

The following elements are foreseen in the strategy:

- Establishment of the Energy Efficiency Agency
- Introducing Certificates for Energy Auditors
- Building energy codes
- Equipment standards
- Energy Efficiency Fund

The Energy Law 2006

The actual Energy Law 2006 went into force in May 2006 and replaces the Law on Energy of 1997 which has been amended for several times until 2005.

The objectives of the Energy Law of 2006 are to ensure:

- reliable, safe and quality supply of energy and energy fuels to the consumers
- creation of efficient, competitive and financially sustainable energy sector
- efficient development of energy sector
- stimulation of competition on the market, thus respecting the tenets of non-discrimination, publicity and transparency
- energy efficiency enhancement and encouragement of the utilization of renewable resources
- independent competitive work of the Energy Regulatory Commission and
- Protection of the environment from adverse impacts of energy sector activities

[35] Source: Austrian Energy Agency (http://www.enercee.net/macedonia/energy-policy.html)

State Energy Agency

The State Energy Agency, established in January, 2004, is responsible for professional technical support on data management, strategy analysis, policy and project assessment and implementation coordination. The formal determination of the State Energy Authority is set within the new Energy Law and Amendments on the Law on State Administration

Ministry of Economy

The Macedonian Ministry of Economy is the main authority for planning and legislation development in the energy sector. One of the 13 departments of the ministry is the Department of Energy.
The departments area of responsibilities include to conduct energy policy of the state, to create and develop laws and legal documents in conjunction with energy, the restructuring of the energy sector by appropriate measures and to act as a price regulator for energy prices.

Energy Regulatory Commission

The Energy Regulatory Commission of the Republic of Macedonia is regulatory body which is fully independent from the interests of the energy industry and the Governmental bodies. The Energy Regulatory Commission was established in 2002 with the Law on Energy and it is composed of five Commissioners elected by the Parliament of the Republic of Macedonia.
The main competences of the Energy Regulatory Commission are to ensure:[36]

1. safe, secure, continual and quality energy supply to the final consumers
2. protection of environment and nature
3. protection of consumers
4. promotion and protection of a competitive energy market based upon the principles of objectivity, transparency and non-discrimination

[36] See also Macedonian Energy Law 2006

Energy Related Organizations[37]

Association of Power Engineers of Macedonia (ZEMAK)

This organization is the Energetic Association in Macedonia that has, during the last twelve years, established itself in the national and international scientific and professional circles.
The main goal of the organization is to monitor, promote and improve the energy sector in Macedonia.

ZEMAK has historically an important role as a responsible and permanent driver, promoter and initiator for resolving of all-important questions directly or indirectly interconnected with the power energy sector in the country, and therefore the entire economy in the country as well. The main focus of ZEMAK is in macro energy supply

Macedonian Center for Energy Efficiency (MACEF)[38]

The Macedonian Center for Energy Efficiency (MACEF) mission is to increase the Energy Efficiency and Environmental Protection by capacity building, identifying and implementing EE measures in the cooperation with governmental institutions, local self-government units, engineers, donor organization and ecologists at national and regional level.
The Center unites the engineers, investors, ecologists and economists in joint action towards the executive policy decision makers at the governmental level to increase the level of energy efficiency and help mitigate the climate changes. This process enables solid cooperation basis, experience exchange with kindred foreign organizations as well as better accessibility to consulting organization recruiting energy consulting services experts for international or regional projects.

[37] Source: http://www.seenergy.org/index.php?/countries&stat=2&type=3&col=2125
[38] See also www.macef.org.mk

Energy Market Players

The former national power utility Elektrostopanstvo Na Makedonija (ESM) has been split in separate companies for generation and distribution:

ELEM

ELEM is the largest generation company owning 7 hydro power stations, two thermal power plants and three coal mines.
With effect from June 2005, Joint Stock Company Macedonian Power Plants (AD ELEM) for generation electricity state owned was established, as a result of transformation of the Electric Power Company of Macedonia.

The next image gives an overview about ELEM plants and installations in Macedonia

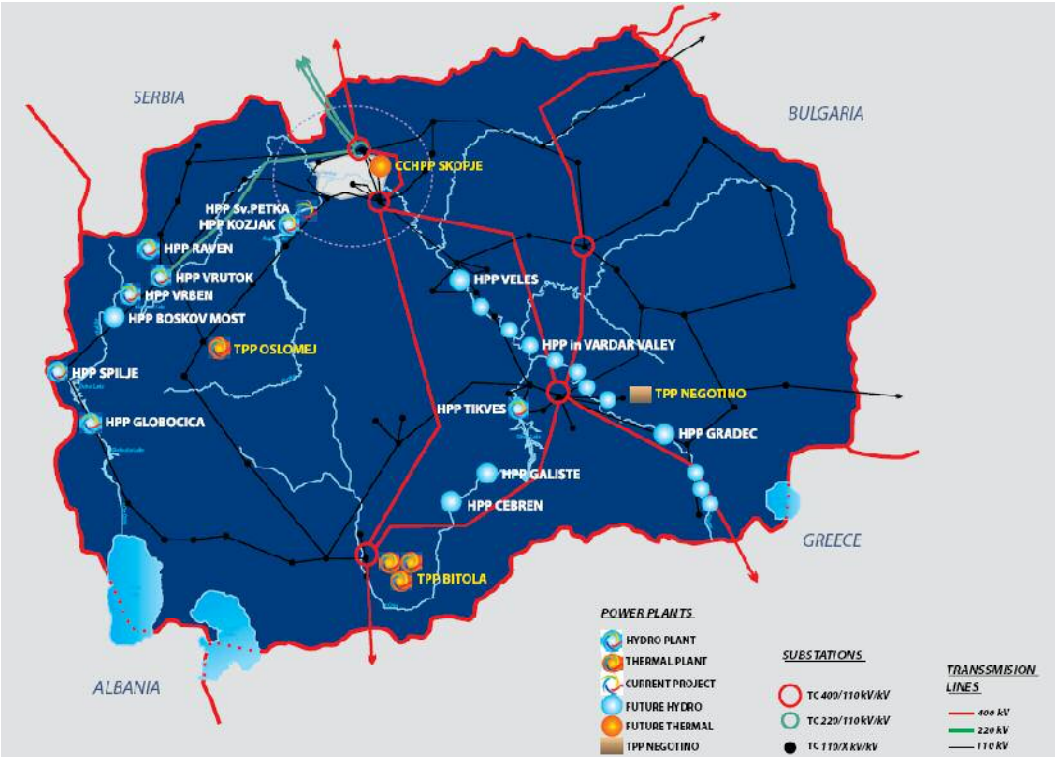


Image 22 ELEM Annual Report 2008
(source: www.elem.com.mk/images/photo/interen/Annual%20Report_2008_ANG.pdf)

TEC Negotino

TEC Negotino is a one-plant generation company (the thermal power plant was supposed to be sold to EVN – this sale is on hold at the moment)

AD ESM

is the distribution company which also owns 11 mini- and small hydro power plants with a total capacity of 35 MW.
This company is now owned by EVN Macedonia AD. AD ESM was sold to EVN in 2006 for 225 Mio Euro.

The low voltage electrical distribution gridline in Macedonia is in exclusive possession of EVN, Austria.

MEPSO[39]

MEPSO – Macedonian Transmission System Operator, is the owner of the high voltage transmission grid in the Republic of Macedonia.

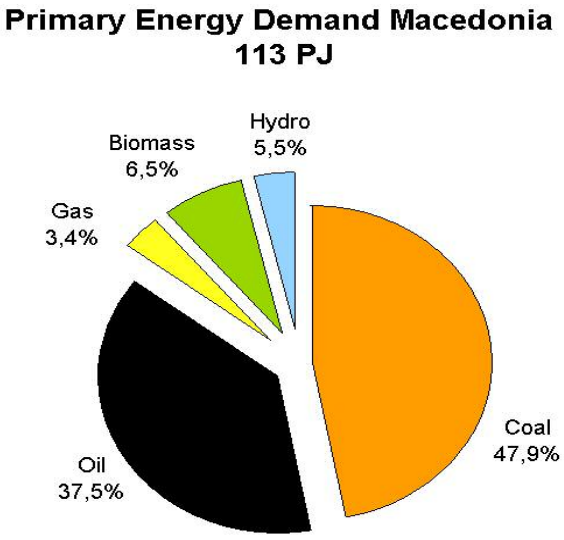
Image 23 MEPSO High Voltage Grid (2009)

[39] See also http://www.mepso.com.mk/index.php?id=18

Energy Situation

Macedonia had a total primary energy demand of 113 PJ in 2007. About 50% of the country´s energy has to be imported. Imports split as follows: oil and oil products 38%, coal 33.5%, gas 2,5% and electricity 6%.

The share in Macedonia's primary energy of different energy sources is shown in the following graph.



Graph 11 Share in primary energy demand in Albania
(source: ENERDATA s.a. - Global Energy & Co2 Data 2007)

The primary energy demand in Macedonia for 2008 went up to 131 PJ from which about the half (51.53%) came from Macedonian own production.

The Macedonian Energy Strategy states, that the adoption of well-proven and readily available technologies including efficient appliances, controls and insulation will ensure the reduction of energy consumption.
It also defines incentives for investment in energy facilities utilizing renewable energy sources, such as wind, solar and hydropower, as well as incentives regarding the enhancement of energy efficiency.

Energy Sectors

Electricity[40]

The Macedonian electricity production is based on 13% hydro power plants and on 87% thermal power plants. Electricity losses in Macedonia are very high with as much as 20%.

The electricity grid is in upgrading state at the moment. Further 400 kV connections to Greece and Bulgaria and a 200 kV transmission line to Albania are planned.

This new grid also gives opportunity to build and interconnect new power plants.

The next two images show the existing and planned status of the electricity infrastructure of Macedonia[41].

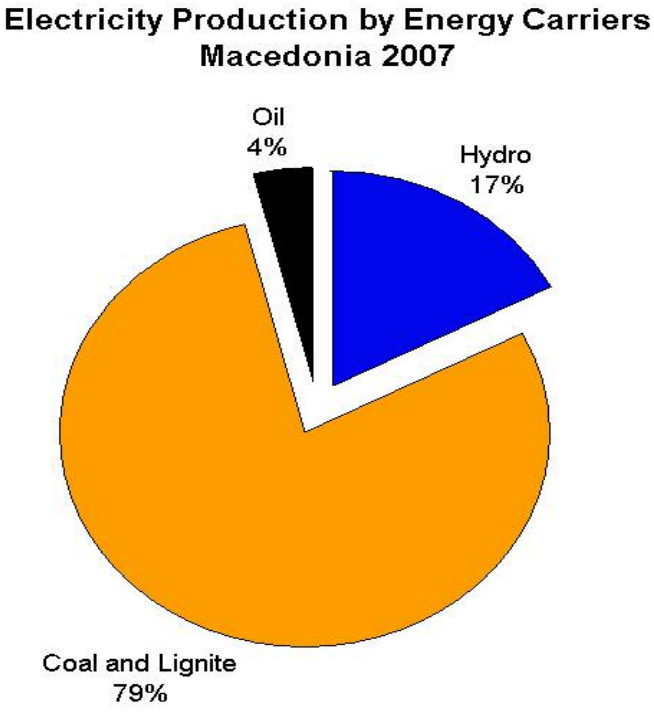
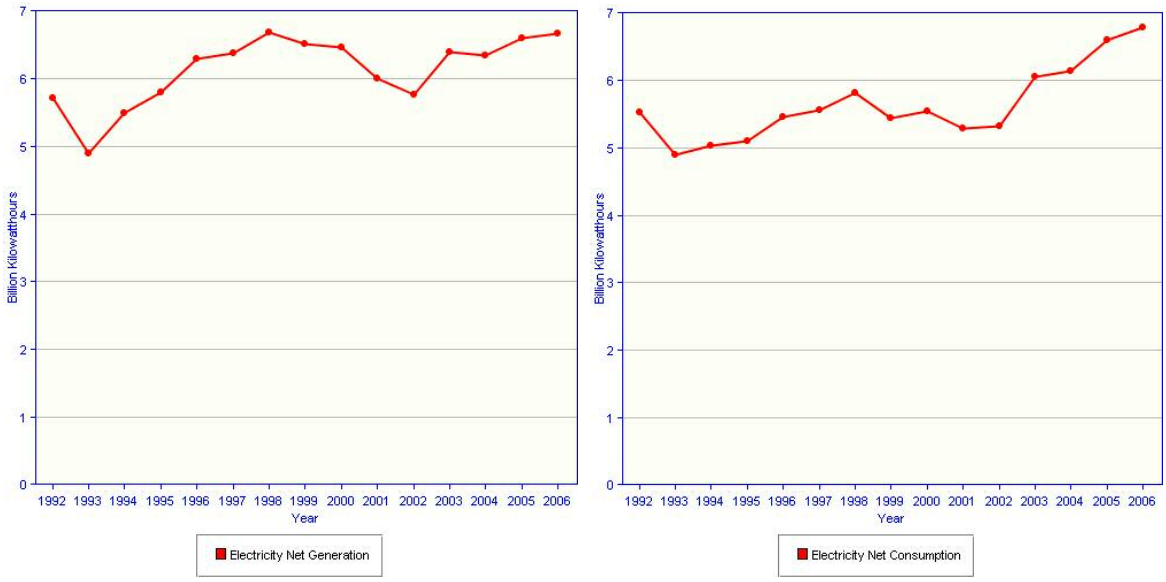


Image 24 Electricity Production by Energy Carriers in 2007

[40] Source: Austrian Energy Agency (http://www.enercee.net/fileadmin/enercee/images/Macedonia/el_pro_mk.gif)
[41] Source: Donevski, B.: A Survey of the Energy Situation in Macedonia, Faculty of Technical Science, University St. Clement Ohridski, Bitola, FYR Macedonia

The Macedonian electricity generation in the year 2006 was 6.67 TWh and the Net Consumption of electric energy in Macedonia was 6.78 TWh.

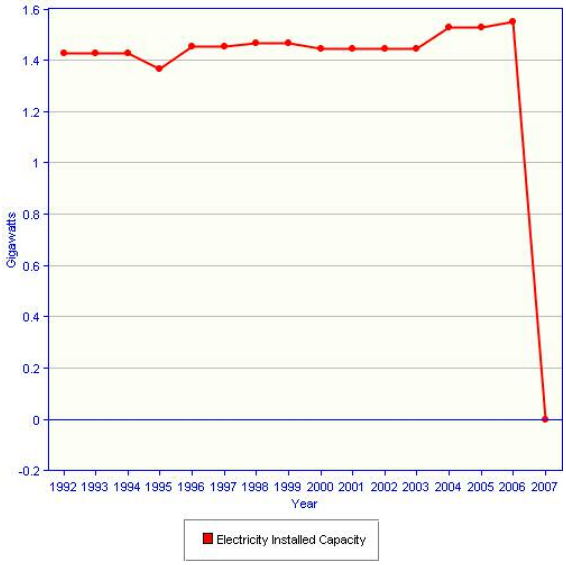
The graphs[42] show the electricity generation and the electricity consumption in Macedonia for the last years. This shows that the demand of electricity went up from 5.2 TWh in 2002 to 6.8 TWh in 2006 (increasing of 1.6 TWh)



Graph 12 Net electricity production and consumption in Macedonia 1980 -2006

The electricity production went up from 5.7 TWh in 2002 to 6.6 TWh in 2006 which is only an increasing of 0.9 TWh. This shows clearly the need for new electricity generation facilities.

In the same period (from 2002 until 2006) the installed generating capacities grow from 1.44 GW to 1.55 GW.



Graph 13 Installed electricity capacity in Macedonia

[42] Source: eia - Energy Information Administration (http://tonto.eia.doe.gov/country/country_energy_data.cfm?fips=MK)

Oil and gas

Macedonia is a 100% importer of oil and oil products. There are no oil or natural gas deposits in Macedonia. In 2007 were 464,284 TJ of oil and oil products imported. The petroleum sector in Macedonia consists of a refinery in Skopje (OKTA), a petroleum pipeline from the Greek border to the refinery, and a distribution system for petroleum products including terminals and service stations throughout the Republic of Macedonia

The consumption of natural gas in Macedonia was 3,565 TJ in the year of 2007. Macedonia is a 100% gas importer and imports 100 Mio m³ of gas from Russia through a pipeline through Bulgaria.

Coal and Lignite

Macedonia has a proven coal reserve of 750 Mio tons. At the moment Macedonia production of coal is 45,322 TJ[43]

Although most local coal output is low-grade lignite, it is used extensively for domestic energy production. Higher quality anthracite coals and coke (approximately 130,000 t per year) have to be imported for some primary electricity generation and the local metallurgical industry.

Solar Energy

Solar irradiation in Macedonia is amongst the highest in Europe. The most favorable areas record a large number of sunshine hours, the yearly ratio of actual irradiation to the total possible irradiation, reaching approximately 45 % for the mountainous central regions in Macedonia, due to the prevailing weather pattern.
The primary form of solar energy and technology used are flat plate collectors for heating houses and some commercial and public premises. But their contribution to the total energy consumption is insignificant (less than 1 %). Nor is it expected that this figure will increase substantially in the near future, as new consumption could mainly come from new entrants to the market i.e. of new buildings or installations.

[43] Year 2007

Likewise, electricity production from solar photovoltaic sources will be restricted to research or remote locations, primarily for telecommunications.

Wind Energy

Until now there are no considerable wind park projects in Macedonia.
In the moment a country wide wind-atlas is prepared, as a project funded by Electrical Power Company. Necessary measurements are in the phase of realization in 3 quite promising locations, the project is also funded by the Norwegian Government.

Geothermal Energy

There are geothermal dwells in Macedonia which are used for deriving heat for greenhouses, commercial buildings and residential areas. In the year 2003, 543 TJ of heat were produced. The proven potential of thermal energy is 220 MW
The main hydrothermal systems are located in the East and North East of the country in the crystalline rocks of Macedonian-Serbian mountains and are characterized by low TDS (total dissolved solids) and low corrosion activity. A number of geothermal areas composed by separate fields were discovered as a result of investigations from more than 50 prospecting and operating wells with a depth from 40 to 2,100 m.
FYR Macedonia's geothermal development objectives until 2010 are:

1. the reconstruction, modernization, and optimization of existing projects
2. the addition of new projects in the Kochani geothermal system
3. connecting additional hotels to the Bansko heating system and
4. completing the water center at Negorci and the medical center in the Katlanovo Spa

Biomass

Currently, biomass covers about 6% of Macedonia's primary energy demand. Biomass is the second most important energy source for heating (after electricity). In the period from 1999 till 2001, the production of wood fuel and charcoal amounted to 787,000 m^3, that of wood residues 3,638 m^3.

Hydropower

In 2008, in Macedonia seven large hydro power plants were producing at a total capacity of 480 MW. The production capacity of all existing small hydro power plants amounts to 50 MW.

In Macedonia hydro power plants with a total installed capacity of 516 MW count for only 13% of total electric energy production at the moment.

By the end of the year2009 the new hydro power plant of Sveta Petka with a capacity of 2 x 18.2 MW and a planned annual generation of 66 GWh will be completed. Second phase of construction (powerhouse and electromechanical equipment started in 2006 at total planned cost of 65 Mio Euro.

The next table shows the existing and planned hydro power plants of FYR Macedonia

Name	MW	Status	Contractor
Boskov Most	68.20	Planned	
Cebren	347.00	planned	
Cebren	254.10	Planned	
Dosnica	4.10	Operating	
Galiste	193.50	planned	
Globocica	46.22	Operating	
Kalimanci	12.60	Operating	
Kozjak	82.00	Operating	
Macedonian Small Hydro	<5MW each	planned	Gvt. of the Rep.of Macedonia
Matka 2 Hydro	9.60	Planned	
Matka Hydro	9.60	completed	EVN Macedonia - Hydropol
Matka-1	4.22	Operating	
Popova Sapka	5.20	Operating	
Raven	16.88	Operating	
Shpilje	84.00	Operating	
Spilje	69.00	Operating	
Sveta Petka (Matka-2)	36.40	Planned	
Tikvesh	92.00	Operating	
Vrben	12.91	Operating	
Vardar Valley	320.00	Planned	12 HPPs
Vrutok	245.20	Operating	

Table 5 Macedonian Hydro Power Plants

Macedonia is divided into three drainage areas, identified by their major rivers:

1. Vardar River water basin/drainage area of 20,535 km^2 with an estimated hydro potential of approx. 4,157 GWh
2. Crni Drim River drainage area of 3,350 km^2 with an estimated hydro potential of approx. 886 GWh
3. Strumica River drainage area of 1,535 km^2

With the hydro potential of Strumica River and other small rivers of Macedonia the total hydro potential is 5,483 GWh.

HPP Matka

The first hydro power plant at Matka was built in 1938 and at time served as the only energy provider for the city of Skopje. The now revitalized hydro power plant of Matka went into service second time in April 2009. It was revitalized by Austrian EVN and has now a capacity of 9.6 MW.
The Matka hydro power plant was revitalized by Czech company Hydropol with the turbines coming from GE in Norway and generators from INDAR of Spain.
The new plant runs fully automatic with remote surveillance and handling.

HPP Matka 2

Slovenian company Riko civil engineering has won the tender to construct the Matka 2 hydro power plant.
Riko will build the plant and its 70m dam in association with the Macedonian contractors Beton, Mavrovo, FAKOM, EMO Ohrid and Makmonting, along with Korona, Litostroj and Gopla of Slovenia.

Macedonian Small Hydro Projects

In September 2007 Macedonia´s Energy Ministry announced the construction of 27 small hydro power plants (<5 MW each)
Contracts were offered on a design, build, operate and transfer basis. The concessions are granted for 20 years.

HPPs Cebren and Galiste

In July 2009 Macedonian Economy Minister Fatmir Besimi announced the course of public bidding procedures on the hydro-plants Cebren and Galiste.
The Government announced the second international tender for construction of the two plants on the Crna River in late 2008.
The project of Cebren (347 MW) and Galiste (193.5 MW) HPPs is estimated at about 700 Mio Euro.

Vardar Valley

For the years 2010 till 2015 there are 12 HPPs with a total installed capacity of 320 MW planned between the town of Skopje and the Greece border.
The power production is estimated with more than 1,000 GWh.

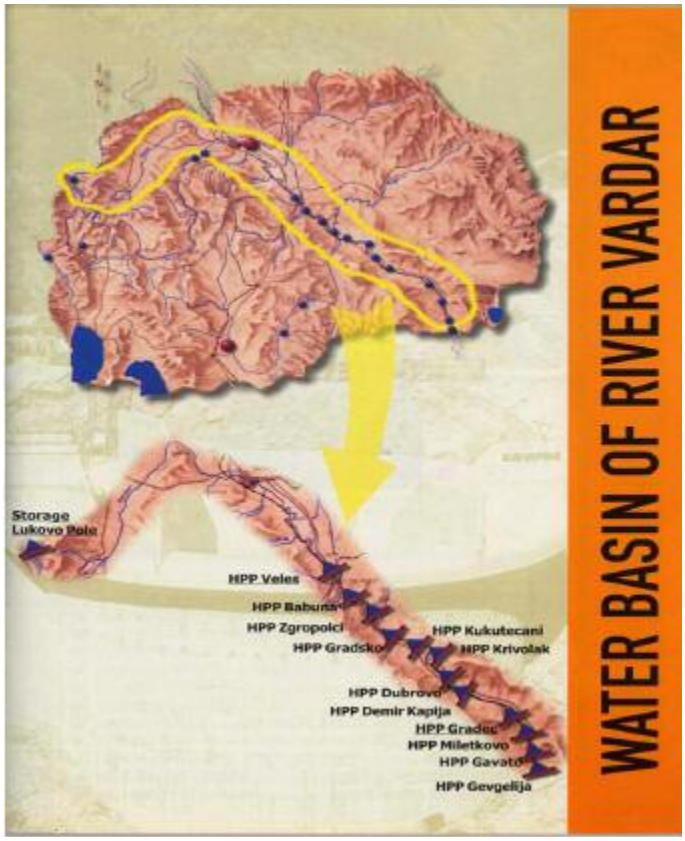


Image 25 Vardar Valley HPP - plan (source: Invest macedonia (www.investmacedonia.com)

Serbia

Image 26 Map of Serbia on the European Continent (source: different internet public domains)

The Republik of Serbia is located in the southeast of Europe. Serbia has common borders with Hungary to the north, Romania and Bulgaria to the east, the Republik of Macedonia to the south and Croatia, Bosnia and Herzgovina and Montenegro to the west. Serbia regards Kosovo as an integral part of its territory, and so there is also a common borderline to Albania.

Serbia[44] has an area of 88,361 km² and a total population of 7.35 Mio excluding Kosovo with an area of 10,908 km² and a population of 2.1 Mio. The capital of the Republic of Serbia is Belgrade with a population of 1.6 Mio living in the metropolitan area. The largest cities, besides Belgrade, in the Republic of Serbia are Novi Sad (300,000), Nis (236,000) and Kragujevac with a population of 147,500.

Serbia was a part of the former Socialist Yugoslavia, which broke apart in mainly two wars in the 1990s. From 2003 to 2006, Serbia has been part of the "State Union of Serbia and Montenegro". In 2006 the Republic of Serbia became an independent state following the breakup of a union with Montenegro.

[44] Source: Statistical Office of the Republic of Serbia (http://webrzs.stat.gov.rs/axd/en/index.php)

Serbia is a member of the United Nations, the Organization for Security and Cooperation in Europe, and the Council of Europe which it presided over in 2007. It is also a potential candidate for membership in the European Union.

The official currency of Serbia is the Serbian Dinar (RSD)[45]

Serbian climate varies between a continental climate in the north with hot humid summers and cold winters and an Adriatic climate in the southern regions with hot dry summers and relatively cold winters with heavy snowfall.

The highest point in the Republic of Serbia is Mount Deravica in Kosovo with an altitude of 2,566 m. Lowest point is on River Danube near the town of Prahovo with 17 m above sea level.

Legal Framework[46]

According to the constitution of the Serbian Government there are several ministries related to energy and environmental protection:

Ministry of Mining and Energy

The ministry of mining and energy is among others responsible for

- Electric Power Sector
- Energy Sector
- Energy Balance of the Republic of Serbia
- Oil and Gas Industry

[45] 100 RSD equal 1,067 € (source: http://currate.com/basic.php)
[46] Source: Serbian Government (http://www.srbija.gov.rs/)

Ministry of Science and Environment Protection

Ministry is in charge of:

- initiating, to provide and implement quality issues for rapid and sustainable development.
- overtaking and applying obligations and best available practices in the field of environmental protection on local and global level

Energy Related Organizations[47]

Serbian Energy Agency

The Serbian Energy Agency was established in August 2004 as the regulatory body i.e. legal entity with all rights, liabilities and responsibilities regulated in the Energy Law and other regulations.

Serbian Energy Efficiency Agency (SEEA)[48]

Serbian Energy Efficiency Agency was founded by Governmental Decree and started its operation in September 2002. Taking into consideration the current state within energy efficiency issues and renewable energy sources, energy policy objectives, as well as the contemporary practice in European countries, Ministry of Mining and Energy recognized the need for a national agency.

Energy Efficiency Agency is formed as special republic organization meaning separate legal entity. The Agency was registered in the Trade Court in Belgrade on 4 October 2004. The Agency started regular operation by the same day.

The basis of the Serbian energy policy is incorporated in Serbian Energy Law and Energy Development Strategy up to 2015[49].

[47] Source: http://www.enercee.net/serbia/administration.html
[48] See also http://www.seea.sr.gov.yu/English/Prezentacija1.htm
[49] Both documents can be downloaded from the Ministry of Mining and Energy web site. (http://www.mem.sr.gov.yu)

Serbian Chamber of Commerce[50]

Serbian Chamber of Commerce is an independent professional business association promoting interests of enterprises, entrepreneurship and other forms of organizations involved in the economic activity on the territory of the Republic of Serbia bound by common business interests. Relying on experience, accepting euro continental type of chambers of commerce and respecting its own tradition, the Law on Chambers of Commerce regulates functioning of chambers of commerce in Serbia in the contemporary environment.

Regional Energy Efficiency Centers of Serbia

In recent years regional energy efficiency centers in Serbia have been revitalized. They bend on universities' sources in the four largest cities: Belgrade, Novi Sad, Kragujevac and Nis. They closely co-operate with the Ministry of Mining and Energy and Serbian Energy Efficiency Agency.

Energy Market Players[51]

Elektromreža Srbije (EMS)[52]

Elektromreža Srbije is a public enterprise for electric energy transmission and transmission system control and was founded in July 2005 by decision of the government of the Republic of Serbia.
EMS is 100% owned by the Republik of Serbia.

Core Acitivities of EMD:

- Transmission of electric energy
- Transmission system operation
- Organization of elektricity market
- Trade of electric energy for ancillary services
- Research and Development

[50] See also http://eng.komora.net/
[51] Source: http://www.enercee.net/serbia/energy-market-actors.html
[52] See also http://www.ems.co.yu/eng/index.htm

- Design, construction, maintenance and operation of networks belonging to transmission system and electric power facilities and other power facilities
- Design, construction, maintenance and operation of telecommunication facilities and units
- Technical examination and analysis
- Engineering
- Foreign trade affairs

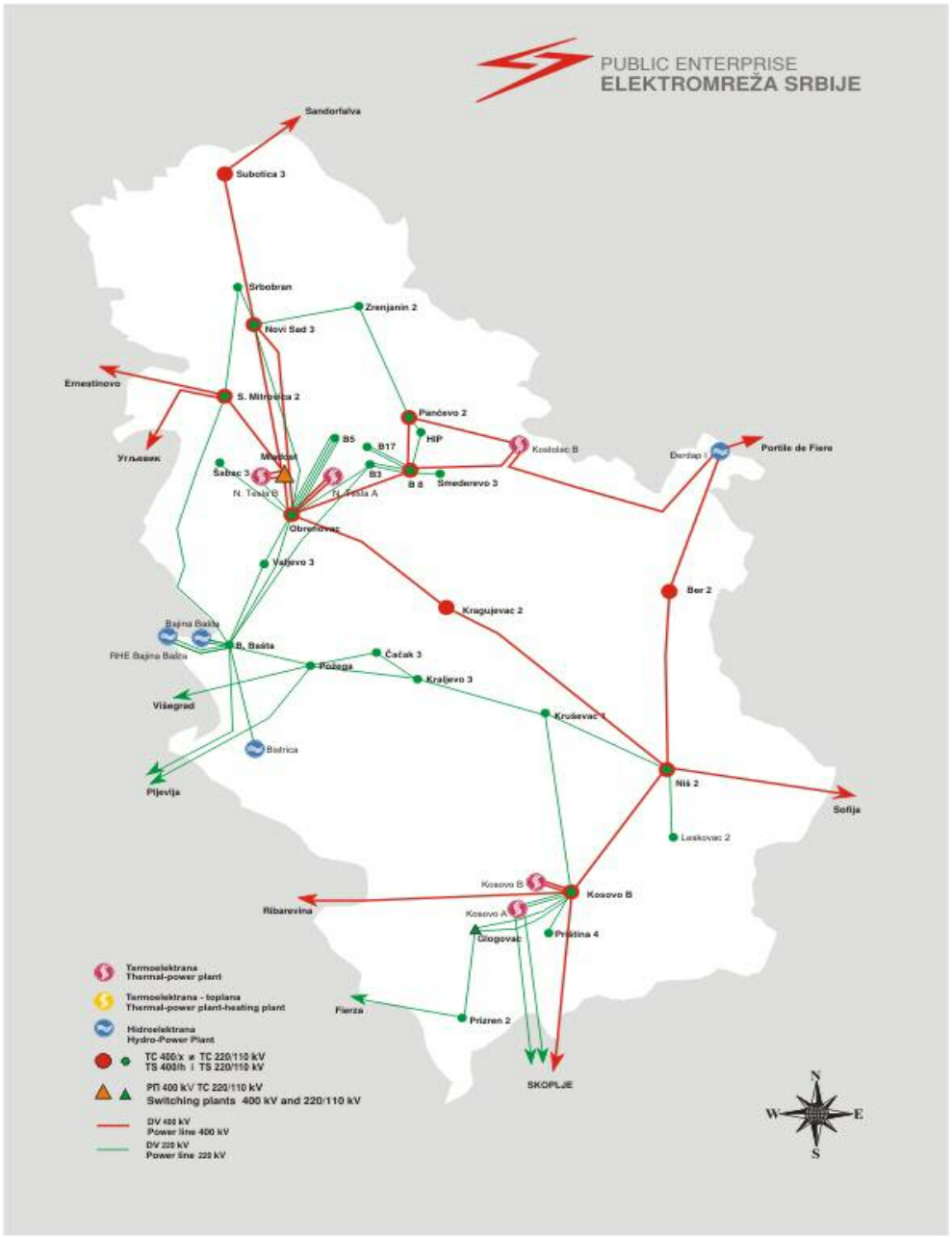


Image 27 EMS Power Systems in Serbia (source: EMS 2008)

Electric power industry of Serbia (EPS)[53]

Electric power industry of Serbia is a public enterprise and the only electricity provider in the Republic of Serbia and was established by Decision of the Government of Serbia which entered into force on 1 July 2005.
The Republic of Serbia is 100% owner of EPS.

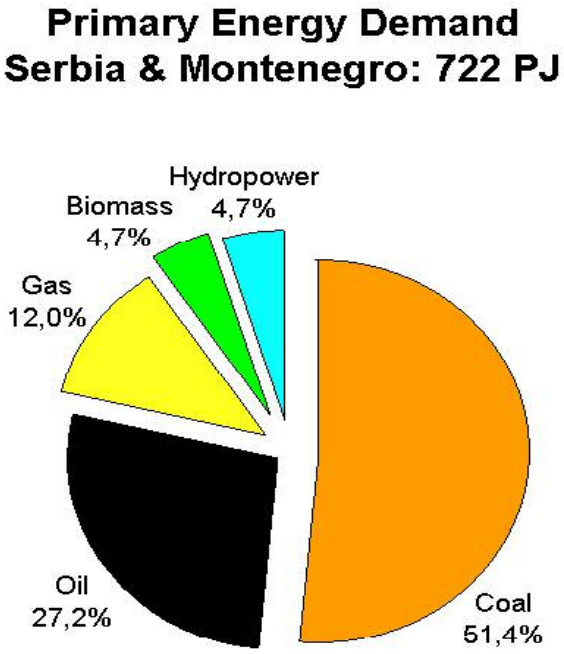
Basic task: meeting all the electric power requirements of the economy and inhabitants of the Republic of Serbia.

Activities:
Electric power generation; electric power distribution and distribution system management; electric power trade; coal production, processing and transport; steam and hot water production in combined heating processes; water power utilization and services in river and lake traffic; wholesale trade in fuel and similar products; research and development; design, construction and maintenance of energy and mining plants; design, construction and operation of telecommunication facilities; engineering.

[53] See also http://www.eps.rs/english.htm

Energy Situation

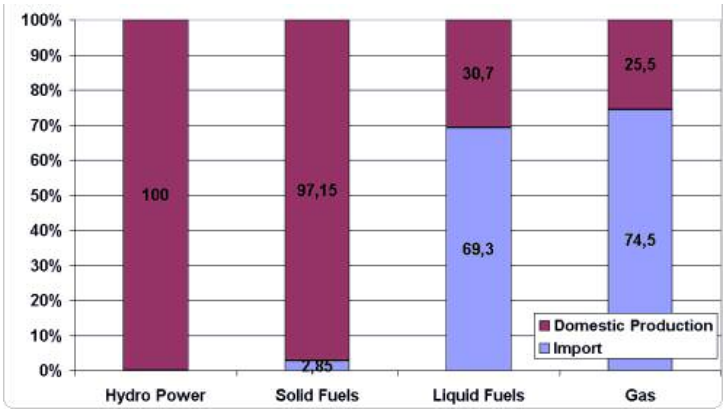
Serbia has a total primary energy demand of 740 PJ in the year 2006. The share of different energy sources is shown in the next graph:



Graph 14 Share in primary energy demand in Serbia (source: ENERDATA s.a. - WORLD ENERGY DATABASE [2008])

Energy Sectors

Serbia is a country with high primary energy imports, especially in the field of solid fuels oil and gas. The next graph shows the relation between own production and imports of primary energy.

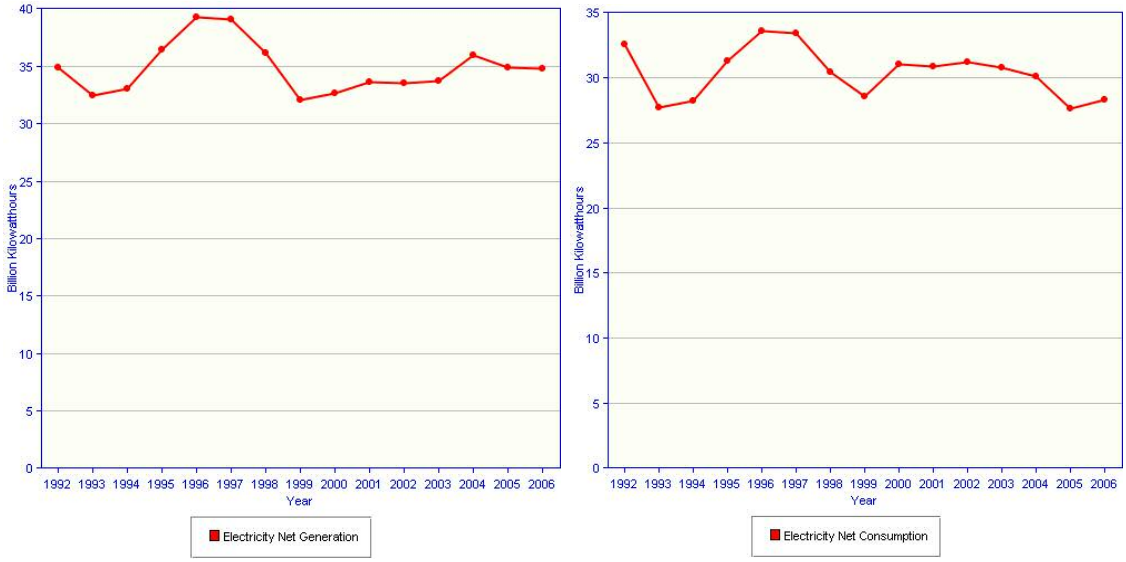


Graph 15 relation between own production and imports (source: Serbian Government)

Electricity

The electricity production in Serbia widely depends on thermal power plants which have 62% of the installed capacity and hydro power plants which have 34% of the installed capacity. A small amount (approx. 4%) of capacity is provided by oil and gas fired combined heat and power plants (CHP). The total installed electric production capacity in the Republik of Serbia is 8,355 MW.

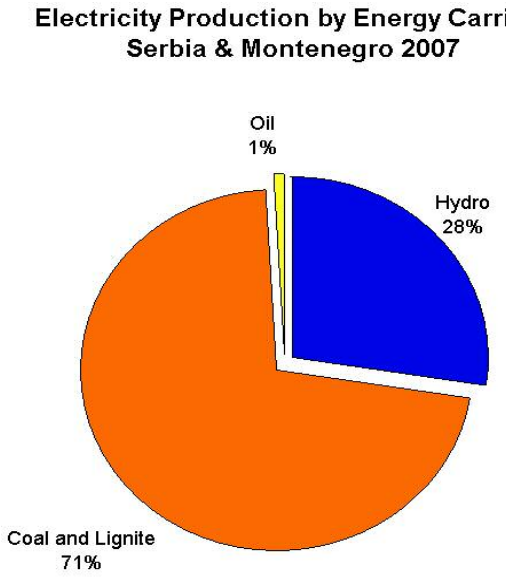
The Net electricity generation in Serbia in the year 2006 was 34.84 TWh. In the same year 28.31 TWh of electricity were consumed.
This made Serbia to an electricity exporting country.



Graph 16 Net electricity production and consumption in Serbia 1980 -2006

In the time from 2002 until 2006 the installed capacity in Serbia went down from 9.315 GW to 8.732 GWh in 2006. This decrease from 2002 till 2006 of installed electric power in Serbia is based on the shutdown of power plants for maintenance and upgrading purpose. The decrease from 2006 to 2007 has political reasons. Serbia ended the union with Montenegro and the Montenegrin capacity fell out of statistics for that reason

The next graph shows the share of electricity production according to energy sources in the year 2007.



Graph 17 source: Enerdata - Global Energy and CO2 Data 2009

Oil and Gas

The primary production of oil in Serbia was 26,911 TJ compared to imports of 105,774 TJ in 2007.

The local production of natural gas was 9,691 TJ compared to 76,647 TJ imported gas.

Production of the oil derivatives is done at: NIS – Refinery Pancevo and NIS – Refinery Novi Sad. Cumulative capacity of both refineries is total 7.3 Mio tons of primaries processing P/A with corresponding secondary capacities.
Existing complementary and compatible production structure builds complete technological complex.

In addition there is extensive and developed sale network throughout Serbia. It comprise wholesale and retail sale of derivatives, motor oils lubricants and gas.

Oil transportation goes via pipeline –Janaf – Omisalj, Croatia to Pancevo and Novi Sad refineries. Alternatively oil and derivative transport is done by river tankers via rivers Danube and Sava.

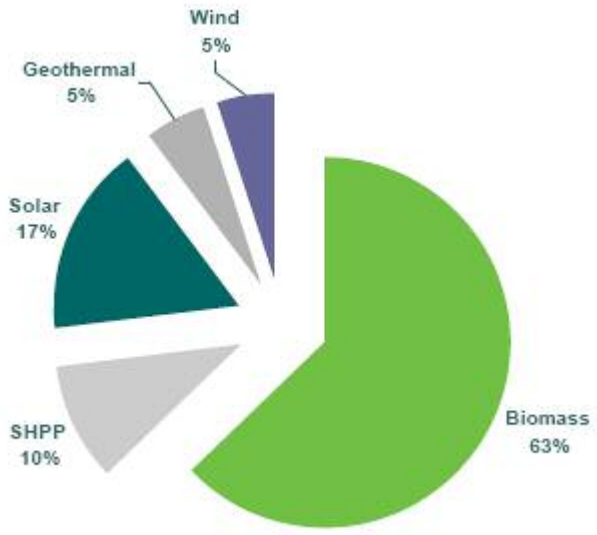
Coal and Lignite

Production of coal (lignite) for the thermal power plants is done in open pit mines of the mining basins of Kolubara and Kostolac. In 2008 37,951,494 t of lignite were produced in Serbia[54].

The local Serbian coal production is 97.15% of the total primary demand for coal in the Republic of Serbia.

Renewable Energies

The production from renewable energy sources is not yet under the regulative, so there is an absence of feed-in tariffs and similar mechanism and instruments that subsidize these favorable sources of energy.



	Potentials (Mtoe)
Biomass	2.40
SHPP	0.40
Solar	0.64
Geothermal	0.20
Wind	0.19
TOTAL	3.83

Graph 18 Serbia's technical potential for RES (source: Serbia Investment and Export Agency (www. siepa.gov.rs)

[54] Source: EPS – annual Report 2008 (http://www.eps.rs/publikacije/godisnji_izvestaji/EPS%20Annual%20report%202008.pdf)

Wind Energy

At present there are no wind turbines in operation in the Republic of Serbia.

Image 28 Serbian wind data based on 10m height, source: SIEPA, www.siepa.gov.rs)

According to a study, made by the University of Belgrade in 2003 the theoretical wind potential in Serbia is 1,300 MW. This potential will lead to a energy production of 22.3 TWh/year[55].

Solar Energy

As in the case of other countries in the area, solar levels in the former Yugoslavia including Serbia and Montenegro are among the highest in Europe.
Most areas record a large number of hours of sunlight, with the yearly ratio of actual irradiation to the total possible irradiation reaching approximately 50 %.

The annual sale of solar flat plate collectors is around 250,000 m². Some 28,000 solar thermal units were in operation, replacing the equivalent of 140 GWh of fossil fuel derived energy being used mainly for water and space heating in the domestic and tourist sectors.

[55] Source: SIEPA (www.siepa.gov.rs)

Geothermal Energy

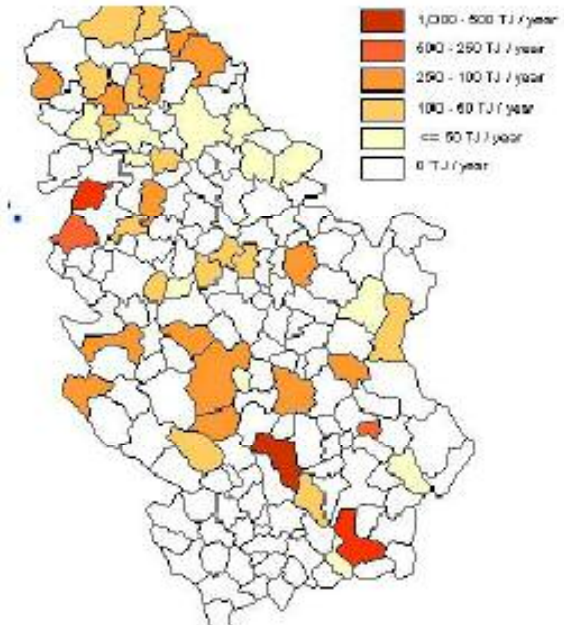


Image 29 Geothermal Potential of Serbia, source: SIEPA (www.siepa.gov.rs)

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 at the moment. The territory of Serbia has favorable geothermal characteristics.

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 in agriculture and for space heating with heat exchangers and heat pumps.

Biomass

Biomass resources represent a significant potential energy source for Serbia. Forests occupy nearly 30,000 km², containing over 300 Mio m³ of biomass.

The estimated renewable biomass potential is about 1.8 Mtoe. It is also estimated that the non-commercial biomass share in total primary energy production is about 10 %. Biomass is used mainly in form of burning wood waste.

Usable energy potential of plant waste derived from agriculture is estimated to be 3.8 Mtoe per year. Animal waste is used for biogas production in biodigestors. Taking into account cattle breeding in Serbia, the estimation is that usable energy potential of animal waste is about 0.45 Mtoe per year. Energy potential of industrial and municipal waste in Serbia is estimated to be 1.4 Mtoe per year. Besides heat energy production realized by burning various industrial waste, municipal waste, and especially by burning plant waste, as well as fossil fuel savings, waste use for energy production is very important for the environment.

Hydro Power

The total capacity of EPS´s hydro power plants was 2,835 MW in 2008. With this capacity 10.5 TWh of electricity were produced. The remaining technical and economical feasible potential of hydropower in Serbia is approx. 2,000 MW or 7 TWh.

Selection of Serbian larger HPPs

Name	MW	status	contractor
Arilje	7.2	Operating	
Bajina Basta	364.0	Operating	
Bajina Basta Hydro PP	381.6	upgrading	50,4 MW additional
Bajina Basta Psp	614.0	Operating	
Bistrica Eps	103.9	Operating	
Brodavero 1	23.0	Planned	Capital Corp
Brodavero 1	25.0	Planned	Capital Corp
Celije	4.0	Planned	
Djerdap/Iron Gate I	1058.0	Operating	
Djerdap/Iron Gate II	270.0	Operating	
Kokin Brod	22.5	Operating	
Komarnica	168.0	Planned	
Koznjar	3.7	Operating	
Lisina	25.4	Operating	
Liverovici Dam	7.7	Operating	
Medjuvrsje	7.0	Operating	
Ovcar Banja	6.0	Operating	
Perucica	365.5	Operating	
Pirot	80.0	Operating	
Piva	342.0	Operating	
Potpec	51.0	Operating	
Raska	6.3	Operating	
Ribarici	46.7	Planned	
Ujman/Gazivode	35.0	Operating	
Uvac	36.0	Operating	
Vrutci	32.0	Planned	
Zvornik	92.8	Operating	

Table 6 Serbian Hydro Power Plants

The potential for hydro power in Serbia is shown in the next image:

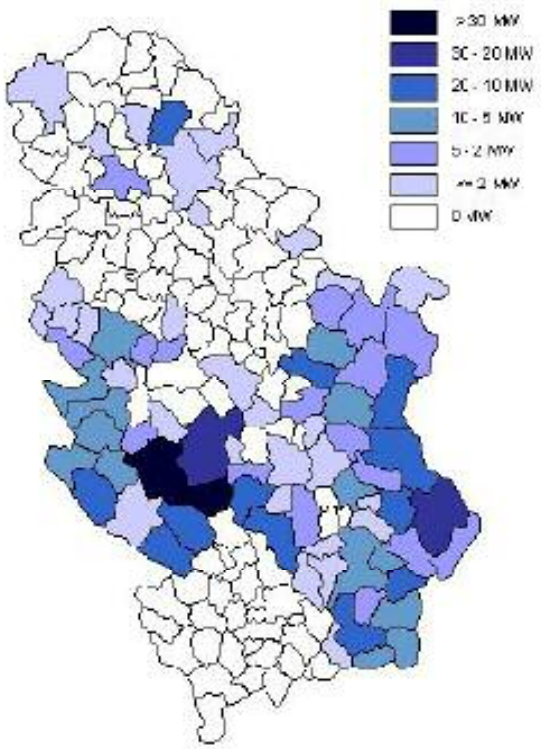


Image 30 Hydro Potential in Serbia (source SHPP Cadastre 1987)

Hydropower stations ready for expansion and modernization:

Brodarevo 1 and Brodarevo 2

In February 2009 Reservoir Capital Corporation was awarded the licenses for the Brodarevo 1 and Brodarevo 2 hydro power plants.

Brodarevo 1 with a planned capacity of 23 MW and three turbines covers the River Lim upstream of Brodarevo to the Montenegro border. The River Lim is a tributary of the River Drina, one of the major waterways of the region, which is sparsely populated, with most of the surface rights along the River Lim owned by the state.

Brodarevo 2 with a planned capacity of 25 MW and three turbines covers the River Lim down-river of the town of Brodarevo, to the Bosnian (Serbian Republic) border.

Bajina Basta

Serbian electricity company Elektroprivreda Srbije has advanced the refurbishment of the 381.6-MW Bajina Basta hydroelectric project on the Drina River.
The reconstruction work began June 2, 2009, at Bajina Basta in Perucac.[56].
Elektroprivreda Srbije awarded a contract in 2007 to Andritz Hydro of Austria[57] for complete modernization of the project, which was built in 1966.)

The 65 Mio Euro contract includes complete modernization of electro-mechanical equipment, increasing each of the four turbine-generators from 95.4 MW to 108 MW. Serbian companies participating in the refurbishment include Minel, Mihailo Pupin Institute, Gosa-Montaza, Sever, and Elektroiszgradnja. Total project capacity upon completion, expected by December 2012, will be
432 MW, which is a 13 percent increase in capacity.

Vrutci[58]

The Canadian Reservoir Capital Corporation, whose operations are focused in the Republic of Serbia with a mandate to acquire and developed natural resource opportunities in Serbia and Southeast Europe, submitted an application to the Serbian Ministry of Mining and Energy for the Vrutci HPP project in August 2009. If granted, this would be the third license for Capital Corporation

The existing Vrutci dam and reservoir were constructed in 1984 on the Djetinja River to provide a water supply and flood protection for the municipalities of Uzice and Sevojno. The dam is a double-curvature arch, 77 meters high, 241 meters long and contains approximately 54 Mio cubic meters of water.
The proposed Vrutci Hydro Power Project ("Vrutci HPP") will have an installed capacity of 32 MW and estimated initial production of 45 GWh per year. Capital Corporation has enjoyed strong support from local leaders in industry and government regarding this project and we look forward to working with the municipality of Uzice to develop the Vrutci HPP.

[56] Source: State News Agency „Tanjuk“ 06/05/09
[57] Source: HydroWorld Magazine 11/23/07
[58] Source Reservoir Capital Corporation (http://www.reservoircapitalcorp.com/s/Home.asp)

Piva (Montenegro)[59]

Elektroprivreda Crne Gore A.D. (EPCG) plans to rehabilitate and modernize the Piva hydro power plant in Montenegro, a cavern-type power station with a total installed capacity of 342 MW.
Within German Financial Cooperation with Montenegro, EPCG intends to continue the rehabilitation of the complex power plant installations in order to extend the power plant's lifetime and safeguard its reliability. The new project will extend over the majority of the plant's different components and will be made up of replacement / rehabilitation of electrical and electro mechanical installations, hydraulic steel structures and rehabilitation of different parts of the civil works.

Djerdap 1

In April 2008, Electric Power Industry of Serbia (EPS) has opened a tender for the works on the renovation of Serbia's biggest hydro plant – Djerdap 1 on the River Danube.
In March 2009 the Russian company Silowje Maschiny (Power Machines) won the tender and started renovation in September 2009.
The modernization of the 6 Turbines will increase the installed capacity from now 174 MW to 201 MW each, which adds another 162 MW.
The total costs are announced with 122.9 Mio Euro and the upgrading will be finished in 2015[60].

[59] Sourc: Water Power Magazine (www.waterpowermagazine.com)
[60] Source Vienna Online, 20.03.2009

Summary

Albania

Albania has set its goal for greenhouse gas reduction at a 20% reduction of emissions until 2020 (based on the amount of 1994). About 95% of this reduction can be achieved by energy saving and the use of renewable energy sources.

The expansion and securing of energy supply is a number one goal of the Albanian government. It has expressed its will to utilize it hydropower potential for energy production to reduce the dependency on energy imports.

Albanian government has also expressed its will to create and maintain a good framework for foreign investments in the energy sector. Foreign Investors and production companies are invited to invest, built and operate small, medium and large hydropower plants. Concessions for operating these powerplants are given for up to 30 years.

Albania has a major hydropower potential of which only 35% so far is being exploited. The total hydropower reserves are estimated with 3,000 MW and the potential of annual generation of 10 TWh.

At present new hydropower plants are considered in the south part of Albania (Vjosa and Devoli Rivers).

Based on information from the Albanian Ministry of Economy, Trade and Energy[61] until April 2009 hydropower concessions with a total capacity of 600 MW have been issued; most of them to European licensees. 7 more concessions with a total capacity of 270 MW are under negotiation.

Austrian involvement on the market:

Austrian EVN has already several licenses for building new hydropower plants on the Devoli River and Verbund AHP is starting with the construction of the two Ashta hydropower plants.

Andritz Hydro is also on the market as a supplier for hydro turbines.

Künz takes already part on the Ashta ½ bidding process for hydraulic steel structures and TRCMs.

[61] Source: press release of Mrs. Mimoza Simixhiu, Director of Licences & Management of Contracts, General Directorate of Regulation, Ministry of Economy, Trade and Energy

Bosnia and Herzegovina

Bosnia and Herzegovina has signed and ratified the Kyoto Protocol. As non-Annex I country, BiH is not bound by specific targets for greenhouse gas emissions.

In BiH a very big number of hydropower plants and other infrastructure were heavily damaged during the Balkan wars.

Until now there is no energy strategy for Bosnia and Herzegovina. The government supports the expansion of hydropower for electric energy production. The goal is to meet 20 %of the country's electricity demand from water power by the year 2020.

Bosnia and Herzegovina has a big potential for hydropower. Estimated technical and economical potential is 5,600 MW from which only about 50% are used.

The existing technical feasible potential for hydropower in BiH is 6.8 GW (24 TWh) and the economical feasible potential 5.6 GW.[62] At present 2.63 GW are used. The estimated potential for small hydropower is 31 MW or 2.5 TWh

Austrian involvement on the market

Austrian involvement on the market is limited at the moment. Austrian Power & Environment Technology (formerly Waagner Biro AG and Simmering Graz Pauker) has assisted the Bosnian Elektroprivreda BiH with the construction of HPPs with a total rated output of 200 MW.

Künz has already supplied a trash rack cleaning machine for Jajce and is at the moment preparing an offer for the delivery of hydraulic steel structures and TRCMs for 7 hydropower plants on the Bosna River.

Several Austrian companies bemoan the fact that the bureaucratic hurdles are a major obstacle to investment .These are attributable to the complex administrative structure of the country between nation state and two "entities", Republika Srpska and the Federation of Bosnia and Herzegovina.

[62] Source: P. M. Gvero, University of Baja Luka, The Potential of Renewable Energy Sources in Bosnia and Herzegovina, Climate Change in South-Eastern European Countries: Causes, Impacts, Solutions, Graz, Austria, 2007
Austria, 2007

Macedonia

Macedonia as a non Annex I country of the Kyoto protocol, has set a reduction of 30% of greenhouse gas emissions as a individual goal until 2020 (Basis is 1994).

In the Republic of Macedonia, there is an ongoing process of privatization of the energy sector.

Macedonia plans to harmonize its policies, including the ones on environment and energy, with those of the European Union.

In October 2005 the Republic of Macedonia has signed the treaty for establishment of an European Energy Community in Athens, Greece.

The estimated technical and economical potential in hydropower in Macedonia is 1,200 MW from which 260 MW is small hydro potential. In the year 2008 the installed hydropower capacity was 530 MW.

In 2007 the Macedonian government tendered 88 potential hydropower plants[63]. The tender ended with participation of 40 bidders which delivered in total 160 offers. Until now 41 concessions are granted.

Existing hydropower infrastructure of Macedonia is mainly built in the ending 40s of the last century and in technical bad condition. That means that in short and mid-term time these HPPs will undergo upgrading and rehabilitation.

In Macedonia companies from former Yugoslavia such as Slovenia, Croatia and Serbia as well as Russian companies are very successful on the hydropower market.

Austrian involvement in the market:

EVN is the sole owner of the Macedonian low voltage grid and plans to invest in rehabilitation of existing power plants and in building new (mainly) hydropower plants.

Künz is not active in the Macedonian market until now.

[63] Source: Cingoski et al., Rehabilitation, *Operation and Transfer of the Small Hydro Power Plants in the Republic of Macedonia, Hydrovision*, 2002.

Serbia

For Serbia there is no data about greenhouse gas emission available nor is there a set goal for reducing greenhouse gases.

The Serbian Energy Law of July 2004 includes the development strategy of the energy sector and defines the use of renewable energy for electricity production as a main target.

Serbia is on the way to privatization of the electric power sector. The government anticipates an improvement of the overall efficiency and reliability of electricity service.

The total technical and economical feasible potential of hydropower in the Republic of Serbia is 4.8 GW. At the moment approx. 2.8 GW are being used for electric power generation. In addition a potential of 490 MW (1.8 TWh) of small hydropower exists, from which at the moment only 6 MW (or 20 GWh) are used.

The Serbian hydropower infrastructure mainly was built in the years after WW II[64]. Most of these powerstations are ready for rehabilitation or upgrading.

At the moment the biggest project in Serbia is the rehabilitation and upgrading of Bajina Basta HPP which is executed by Austrian company Andritz Hydro. The upgraded HPP will be back in full operation by 2013.

Austrian involvement in the market:

Andritz Hydro is very active on the Serbian market - as well in delivering new equipment for hydropower plants being built at the moment, as in refurbishing existing HPPs.

Künz Company is not active in Serbia until now.

[6464] WW II – world war II from 1939 till 1945. After the war Serbia (in the Federation of Yugoslavia) got strong financial support in the power sector from the Soviet Union.

Conclusion

As it was clearly shown in the study, all four countries described are on their way towards European Union integration. The legal background for REN and especially for hydropower is slightly different at the moment, but the will to adopt European legislation in the near future is clearly visible.

The technical and economical potential and most important, the need for expanding existing hydropower stations and for building new hydropower plants is given in all four countries.

At present already a number of well known European and also Austrian companies are active in the South Eastern European Countries.

In my opinion the study done in Albania, Bosnia & Herzegovina, Macedonia and Serbia shows very clearly that for the Hans Künz Company it is very advisable to join this market as soon as possible.
The way, how this should be achieved will be discussed within the company. Basically are three ways to choose from:

1. **Join Austrian companies** being already active in the market as a sub supplier for hydraulic steel structures (i.e. Andritz-Hydro)
2. **Approach Austrian energy suppliers** active in SEE (VERBUND, EVN, Wienstrom) via existing contacts and propose delivery of equipment - and
3. **Join the market independently** by active market research and participation in upcoming tendering processes much more active as it is done iat the moment (promotion tours, hydro- and energy fairs and congresses in the region and much more)

Acknowledgement

I am very thankful to everybody who contributed to this Masterthesis.

A special recognition belongs to the supervisor Dipl. Ing. Dr. Gustav Resch, who gave me hints, how to improve my first attempts in writing this thesis.

I also want to mention Mr. Stanko Peric, who is the sales representative for Hans Künz Company for the South Eastern European Region. His inside-knowledge of the hydropower and energy market, as well his good relations to the SEE –country officials and energy providers made it possible to see "behind the scene".

A special thankyou goes also to Dipl. Ing. Michael Geiger from Hans Künz Company and all my other colleagues there for providing company internal information and most of all doing part of my work during the writing.

Last but not least I want to mention my wife Cecile, for her endless patience and moral support during the development of this Masterthesis.

Annex 1

DOING BUSINESS in Albania, Bosnia & Herzegovina, Macedonia and Serbia

This compendium of data compares the business environments of the four countries to the level in Austria and the United States.

(source: www.doingbusiness.org) data for 183 countries available

Enforcing Contracts

The ease or difficulty of enforcing commercial contracts is measured below. This is determined by following the evolution of a payment dispute and tracking the time, cost, and number of procedures involved from the moment a plaintiff files the lawsuit until actual payment.

Indicator	Bosnia and Herzegovina	Eastern Europe & Central Asia	OECD Average
Procedures (number)	**38**	**37.1**	**30.6**
Time (days)	**595**	**450.9**	**462.4**
Cost (% of claim)	**38.4**	**25.6**	**19.2**

Nature of Procedure	Indicator					
	Albania	BiH	Macedonia	Serbia	Austria	USA
Procedures (number)	39	38	37	36	25	32
Time (days)	390	595	370	635	397	300
Filing and service	30	30	40	30	30	30
Trial and judgment	180	385	270	495	277	180
Enforcement of judgment	180	180	60	110	90	90
Cost (% of claim)*	38.7	38.4	33.1	28.9	19	14.4
Attorney cost (% of claim)	21.6	18	18.6	9.43	13.58	8
Court cost (% of claim)	7.86	4	6.9	7.1	4.1	5.39
Enforcement Cost (% of claim)	9.2	16.4	7.6	12.4	0.35	1

* Claim assumed to be equivalent to 200% of income per capita.

Albania
Court information: Tirana District Court
www.gjykatatirana.gov.al

BiH
Court information: Sarajevo Municipal Court
http://www.oss.ba

Macedonia
Court information: Skopje First Instance Court II
www.slvesnik.com.mk

Serbia
Court information: Belgrade Commercial Court

Austria
Court information: Vienna Commercial Court ("Handelsgericht Wien")
http://www.bmj.gv.at/

USA
Court information: Supreme Court of the State of New York, Civil Branch
http://www.nycourts.gov/supctmanh

Employing workers

The difficulties that employers face in hiring and firing workers are shown below. Each index assigns values between 0 and 100, with higher values representing more rigid regulations. The Rigidity of Employment Index is an average of the three indices.

Indicator	Eastern Europe & Central Asia	OECD Average
Difficulty of hiring index (0-100)	**31.9**	**26.5**
Rigidity of hours index (0-100)	**29.9**	**29.9**
Difficulty of redundancy index (0-100)	**25.9**	**22.6**
Rigidity of employment index (0-100)	**29.2**	**26.4**
Redundancy costs (weeks of salary)	**27.8**	**26.6**

	Albania		BiH		Macedonia		Serbia		Austria		USA	
Difficulty of hiring index (0-100)	**44**		**56**		**11**		**78**		**0**		**0**	
Are fixed-term contracts prohibited for permanent tasks?	Yes	1	No	0	No	0	Yes	1	No	0	No	0
What is the maximum duration of fixed-term contracts (including renewals)? (in months)	No limit	0.0	24	1.0	60	0.0	12	1.0	No limit	0.0	No limit	0.0
What is the ratio of mandated minimum wage to the average value added per worker?	0.39	0.33	0.69	0.67	0.28	0.33	0.26	0.33	0.12	0.00	0.21	0.00
Rigidity of hours index (0-100)	**20**		**13**		**20**		**7**		**33**		**0**	
Can the workweek extend to 50 hours (including overtime) for 2 months per year to respond to a seasonal increase in production?	Yes	0	Yes	0	Yes	0	Yes	0	Yes	0	Yes	0
What is the maximum number of working days per week?	6	0	6	0	6	0	6	0	6	0	6	0
Are there restrictions on night work and do these apply when continuous operations are economically necessary?	Yes	1.00	Yes	0.67	No	1.00	Yes	0.33	No	0.00	No	0.00
Are there restrictions on "weekly holiday" work and do these apply when continuous operations are economically necessary?	Yes	0.00	No	0.00	No	0.00	No	0.00	Yes	0.67	No	0.00
What is the paid annual vacation (in working days) for an employee with 20 years of service?	20	0	18	0	20	0	20	0	25	1	0	0

Difficulty of redundancy index (0-100)	**10**		**30**		**10**		**20**		**40**		**0**	
Is the termination of workers due to redundancy legally authorized?	Yes	0	Yes	0	Yes	0	Yes	0	Yes	0	Yes	0
Must the employer notify a third party before terminating one redundant worker?	No	0	No	0	No	0	No	0	Yes	1	No	0
Does the employer need the approval of a third party to terminate one redundant worker?	No	0	No	0	No	0	No	0	No	0	No	0
Must the employer notify a third party before terminating a group of 9 redundant workers?	No	0	Yes	1	Yes	1	No	0	Yes	1	No	0
Does the employer need the approval of a third party to terminate a group of 9 redundant workers?	No	0	No	0	No	0	No	0	No	0	No	0
Is there a retraining or reassignment obligation before an employer can make a worker redundant?	No	0	Yes	1	No	0	Yes	1	No	0	No	0
Are there priority rules applying to redundancies?	No	0	No	0	No	0	No	0	Yes	1	No	0
Are there priority rules applying to re-employment?	Yes	1	Yes	1	No	0	Yes	1	Yes	1	No	0

Redundancy costs (weeks of salary)	56	31	26	25	2	0
What is the notice period for redundancy dismissal after 20 years of continuous employment? (weeks of salary)	13.0	2.0	04. 3	0.0	2.0	0.0
What is the severance pay for redundancy dismissal after 20 years of employment? (weeks of salary)	42.9	28.7	21.7	25.3	0.0	0.0
What is the legally mandated penalty for redundancy dismissal? (weeks of salary)	0.0	0.0	0.0	0.0	0.0	0.0

Trading Across Borders

The costs and procedures involved in importing and exporting a standardized shipment of goods are detailed under this topic. Every official procedure involved is recorded - starting from the final contractual agreement between the two parties, and ending with the delivery of the goods.

Indicator	Eastern Europe & Central Asia	OECD Average
Documents to export (number)	**6.5**	**4.3**
Time to export (days)	**26.8**	**10.5**
Cost to export (US$ per container)	**1,581.8**	**1,089.7**
Documents to import (number)	**7.8**	**4.9**
Time to import (days)	**28.4**	**11.0**
Cost to import (US$ per container)	**1.773.5**	**1,145.9**

Albania

Nature of Export Procedures	Duration (days)	US$ Cost	Nature of Import Procedures	Duration (days)	US$ Cost
Documents preparation	11	130	Documents preparation	12	115
Customs clearance and technical control	2	65	Customs clearance and technical control	2	65
Ports and terminal handling	3	350	Ports and terminal handling	2	350
Inland transportation and handling	3	180	Inland transportation and handling	2	180
Totals:	19	725	Totals:	18	710

Export documents	Import documents
Bill of lading	Bill of lading
Cargo release order	Cargo release order
Certificate of origin	Certificate of origin
Commercial Invoice	Commercial Invoice
Customs export declaration	Customs import declaration
Packing list	Customs transit document
Technical standard/health certificate	Packing list
	Technical standard/health certificate
	Terminal handling receipts

Bosnia & Herzegovina

Nature of Export Procedures	Duration (days)	US$ Cost	Nature of Import Procedures	Duration (days)	US$ Cost
Documents preparation	6	235	Documents preparation	5	180
Customs clearance and technical control	2	75	Customs clearance and technical control	2	80
Ports and terminal handling	5	165	Ports and terminal handling	3	180
Inland transportation and handling	3	650	Inland transportation and handling	6	650
Totals:	16	1125	Totals:	16	1090

Export documents	Import documents
Commercial invoice	Certificate of origin
Customs export declaration	Commercial Invoice
Export license	Customs import declaration
Inspection report	Import license
Packing list	Inspection report
Terminal handling receipts	Packing list
	Terminal handling receipts

Macedonia

Nature of Export Procedures	Duration (days)	US$ Cost	Nature of Import Procedures	Duration (days)	US$ Cost
Documents preparation	4	126	Documents preparation	4	130
Customs clearance and technical control	1	70	Customs clearance and technical control	1	50
Ports and terminal handling	5	560	Ports and terminal handling	4	560
Inland transportation and handling	2	680	Inland transportation and handling	2	680
Totals:	12	1436	Totals:	11	1420

Export documents	Import documents
Bill of lading	Bill of lading
Certificate of origin	Commercial invoice
Commercial invoice	Convention des Marchandises Routiers (CMR)
Convention des Marchandises Routiers (CMR)	Customs import terminal receipt
Customs export terminal receipt	Customs import declaration
Customs export declaration	Transit document: T1

Serbia

Nature of Export Procedures	Duration (days)	US$ Cost	Nature of Import Procedures	Duration (days)	US$ Cost
Documents preparation	2	178	Documents preparation	6	139
Customs clearance and technical control	2	70	Customs clearance and technical control	2	70
Ports and terminal handling	5	250	Ports and terminal handling	3	250
Inland transportation and handling	3	900	Inland transportation and handling	3	1100
Totals:	12	1398	Totals:	14	1559

Export documents	Import documents
Bill of lading	Bill of lading
Certificate of origin	Certificate of origin
Commercial invoice	Commercial invoice
Customs export declaration	Customs import declaration
Packing list	Packing list
Tax certificate	Tax certificate

Austria

Nature of Export Procedures	Duration (days)	US$ Cost	Nature of Import Procedures	Duration (days)	US$ Cost
Documents preparation	2	130	Documents preparation	3	145
Customs clearance and technical control	1	50	Customs clearance and technical control	1	50
Ports and terminal handling	2	200	Ports and terminal handling	1	200
Inland transportation and handling	2	800	Inland transportation and handling	3	800
Totals:	7	1180	Totals:	8	1195

Export documents	Import documents
Bill of lading	Bill of lading
Commercial invoice	Certificate of origin
Customs export declaration	Commercial invoice
Technical standard/health certificate	Customs import declaration
	Transit document

United States of America

Nature of Export Procedures	Duration (days)	US$ Cost	Nature of Import Procedures	Duration (days)	US$ Cost
Documents preparation	2	190	Documents preparation	2	205
Customs clearance and technical control	1	60	Customs clearance and technical control	1	90
Ports and terminal handling	2	400	Ports and terminal handling	1	420
Inland transportation and handling	1	400	Inland transportation and handling	1	600
Totals:	6	1050	Totals:	5	1315

Export documents	Import documents
Customs export declaration	Bill of lading
Bill of lading	Cargo release order
Certificate of origin	Commercial invoice
Commercial invoice	Customs import declaration
	Packing list

Protecting Investors

The indicators below describe three dimensions of investor protection: transparency of transactions (Extent of Disclosure Index), liability for self-dealing (Extent of Director Liability Index), shareholders' ability to sue officers and directors for misconduct (Ease of Shareholder Suits Index) and Strength of Investor Protection Index. The indexes vary between 0 and 10, with higher values indicating greater disclosure, greater liability of directors, greater powers of shareholders to challenge the transaction, and better investor protection.

Indicator	Eastern Europe & Central Asia	OECD Average	Albania	Bosnia and Herzegovina	Macedonia	Austria	USA
Extent of disclosure index (0-10)	6.1	5.9	8.0	3.0	9.0	3.0	7.0
Extent of director liability index (0-10)	4.3	5.0	9.0	6.0	7.0	5.0	9.0
Ease of shareholder suits index (0-10)	6.1	6.6	5.0	6.0	4.0	4.0	9.0
Strength of investor protection index (0-10)	5.5	5.8	7.3	5.0	6.7	4.0	8.3

Annex 2

LIST of COMPANIES and ORGANISATIONS involved in HPP –planning, construction, -operating and maintaining.

(source: internet)

COMPANY	CONTACT NAME	CONTACT TITLE	ADDRESS	TEL	FAX	WEBSITE / E-MAIL
Albania						
Studio Design AD	Avni Dervishi	Director	PO Box 8350 - 2/281 Artan Lenja Str. - 355 Tirana - Albania	+355 42 33352	+355 42 33352	avni_dervishi@yahoo.com
Austria						
Alstom Power Austria AG	Wolfgang Kollicker	Unit Managing Director	Wienerbergstrasse 11B - 1810 Vienna - Austria	+43 1 6088 82435	+43 1 6088 88230	wolfgang.koelliker@power.alstom.com
Braun Maschinenfabrik Gesellschaft M.B.H.	Martin Braun	Managing Director	Gmunder Strasse 76 - 4840 Voklabruck - Austria	+43 7672 72463	+43 7672 75652	office@braun.at
Dr. Krauss ZT GmbH	Peter Neumann	Dipl.-Ing.	15 Dietrichsteinplatz - 8010 Graz Styria - Austria	+43 3168 21426	+43 3168 214 2620	office@zt-krauss.at
Kössler GmbH	Herbert Sattler	Senior Hydro Specialist	122 Hauptstrasse - St. Polten - 3151 St. Georgen - Austria	+43 2742 885 272	+43 2742 885 272 39	h.sattler@koessler.com
Hans Künz GmbH	Michael Heiger	Head, Marketing & Sales	15 Gerbestrasse - 6971 Hard - Austria	+43 5574 688 30	+43 5574 688 319	michael.geiger@kuenz.com
Risk Assessment International - Dipl. Dr. A. Vogel Ltd.	Alexius Vogel	Manager & Shareholder	1/3 Puschmanngasse - 1210 Vienna - Austria	+43 664 162 0726	+43 1 2596 4424	vogel@risk-assessment.at
Simutech	Ronald Ruzicka	CEO	32 Atzgersdorfer Str. - 1230 Vienna - Austria	+43 1 888 36100	+43 1 888 361 049	info@simutech.info
Strabag International GmbH	Mr. Irsiegler		323 Salzburger Strasse - 4021 Linz - Austria	+43 7 323 731 370		pr@bauholding.at
TDV GmbH	Johann Stampler	Dipl.-Ing	5 Gleisdorfer Gasse - 8010 Styria - Graz - Austria	+43 316 821 1531	+43 316 821 531	office@tdv.at
Tschernutter Consulting GmbH	Mr. Tschernutter		10-11 F-abrikssteig - 9500 Villach - Austria	+43 4242 23113	+43 4242 231133	office@zt-tschernutter.at
VA Tech Hydro GmbH	Alexander Schwab	Market Management & Corporate Communications	76 Penzinger Strasse - 1141 Vienna - Austria	+43 1 891 002 659	+43 1 891 001 96	alexander.schwab@vatech-hydro.at
Verbundplan GmbH	Jurgen Wahl		43 Laaer-Berg-Strasse - 1100 Vienna - Austria	+43 1 531 130	+43 1 531 13 ext.54809	vpl@verbundplan.at
Voith Siemens Hydro Power Generation GmbH & Co. KG			55 Linzer Strasse - 3100 St. Pölten - Austria	+43 2742 806 2323	+43 2742 8064 2323	marketing.austria@vs-hydro.com
COMPANY	**CONTACT NAME**	**CONTACT TITLE**	**ADDRESS**	**TEL**	**FAX**	**WEBSITE / E-MAIL**
GEPPERT GmbH			Breitweg 8-10c A 6060 Hall in Tirol - Austria	Phone 43 5223 577880	Fax 43 5223 577882	www.geppert.at

GUGLER HYDRO ENERGY GmbH			Niederranna 41, A-4085 - Austria	Phone 43 7285514	Fax 43 728551420	info@gugler.com
KOESSLER GES MbH			Hauptstrasse 122, St. Polten, St. Georgen A-3151 - Austria	Phone 43 2742 885272	Fax 43 2742 88527239	office@koessler.com
VA TECH HYDRO GmbH and Co			PenzungerStrasse 76, A-1141 Vienna - Austria	Phone 43 1 891003380	Fax 43 1 89100177	www.vatech-hydro.com
VA TECH HYDRO VOEST MCE GmbH			Postfach 36 Lunzerstr. 78 - Linz 4031 - Austria	Phone 43 70 69 87 80 83	Fax 43 70 69 80 25 54	derndor@vamce.co.at
Belgium						
Acotec NV	Bart De Cremer	Commercial Manager	Industrielaan 8 - 9320 Aalst - Belgium	+32 53 838 660	+32 53 836 988	info@acotec.be
JLA & Company	Simon Cuvelier	Engineer	72 rue Pierre Jacques - Moha - 4520 Liège - Belgium	+32 85 211 394	+32 85 250 254	info@jlahydro.de
WILLOT			rue Pierre Jacques 72 - 4520 Moha - Belgium	Phone 32 85 12 13 94	Fax 32 85 25 02 54	jla@inbox.as
Croatia						
Koncar Group			Fallerovo sestaliste 22, 10000 Zagreb, Croatia	+38513655 555	+385 13667 602	info@koncar.hr
Elektroprojekt Consulting Engineers	Thomas Jancijev	Business Development & Advertising	Alexandera von Humboldta 4 - 10000 Zagreb - Croatia	+385 1 630 7747	+385 1 615 2686	tomislav.jancijev@elektroprojekt.hr
Koncar Power Plant & Electric Traction Engineering Inc.	Sime Milisac		22 Fallerovo Set. - 10000 Zagreb - Croatia	+385 1 365 5172	+385 1 366 7515	sime.milisa@koncar-ket.hr
Czech Republic						
CKD Blansko Engineering a.s.	Emil Zizka	General Director	2357/5 Capkova - 67801 Blansko - Czech Republic	+420 533 309 501	+420 533 309 557	gr@cbeng
CKD Blansko Holding	Petr Kligl	Marketing Manager	1 Gellhornova - 67818 Blansko - Czech Republic	+420 516 401 111	+420 516 413 620	
Hydrolink s.r.o.	Martin Exner	Sales Manager	17 Listopadu 984 - 252 63 - Roztoky - Czech republic	+420 2 3391 0968	+420 2 3391 0970	info@hydrolink.cz
Mavel a.s.	Jeanne Hilsinger	Director of Development	1237 Jana Nohy - 256 01 Benesov - Czech Republic	+420 602 315 875		jeanne@mavel.cz
Voith Siemens Hydro Power Generation s.r.o.			39 Edvarda Benese - 301 00 Pilsen - Czech Republic	+420 378 210 730	+420 378 210 178	zdenka.syslova@vs-hydro.com
CINK Turbiny			Chebska 48/73 36006 Karlovy Vary, Czech Republic	Phone 353 449 312	Fax 353 449 595	www.cink-turbiny.cz
HYDROHROM			Strzenec 1 - 25751 Bystrice - Czech Republic	Phone 420 317 793 612	Fax 420 317 793 612	hydrohrom@telecom.cz
COMPANY	**CONTACT NAME**	**CONTACT TITLE**	**ADDRESS**	**TEL**	**FAX**	**WEBSITE / E-MAIL**
HYDROLINK s.r.o.			17, Listopadu 984, 252 63 Roztoky - Czech Republic	Phone 420 2 3391 0968	Fax 420 2 3391 0970	info@hydrolink.cz

MAVEL A.S.			Jana Nohy 1237, Benesov, 256 01 - Czech Republic	Phone 420 317 727345	Fax 420 317 727255	www.mavel.cz
Denmark						
Bruel & Kjaer A/S	Torben Ekvall	Sales Manager	307B Skodsborgvej - 2850 Naerum - Denmark	+45 7741 2806	+45 4580 2937	torben.ekvall@bkvibro.com
Carlsen Power Electronics	Steen Carlsen	Managing Director	the Science Park - 10 Gustav Wieds Vej 10 - 8000 Aarhus C - Denmark	+45 8619 0319		carlsen@power-electronics.dk
Danfoss A/S	Andre Hansen		D25 - 6430 Nordborg - Denmark	+45 7488 7599		andrehansen@danfoss.com
E. Pihl & Son A.S.	Ghassan Farah	Marketing Manager	116 Nybrovej - 2800 Lyngby - Denmark	+45 45 277 200	+45 45 277 100	pihl@pihl-as.dk
Kroll Cranes A/S	N.P. Sorensen	Technical & Sales Manager	2 Nordkranvej - 3540 Lynge - Denmark	+45 48 187 400	+45 48 188 807	krollcranes@krollcranes.dk
Finland						
Kemijoki Aquatic Technology Oy	Ilkka Klymanen	Managing Director	P.O. Box 8131 - Rovaniemi - 96100 Lapland - Finland	+358 40 502 8245	+358 16 740 2216	katinfo@kat.fi
Konecranes	Kari Wallgren	President	PO Box 662 - 05801 Hyvinkaa - Finland	+358 20 42711	+358 20 427 2289	kari.wallgren@konecranes.com
Metso Minerals	Eero Hamalainen	Marketing Communications Manager	PO Box 306 - 33101 Tampere - Finland	+358 2 0484 142	+358 2 0484 141	eero.hamalainen@metso.com
Sandvik OY	Nina Lehtonen	Manager, Marketing Communications	PO Box 100 - 33311 Tampere - Finland	+358 20 544 4059	+358 20 544 120	nina.lehtonen@sandvik.com
Waterpumps WP Oy	Kimmo Rintamaki	Director, Sales & Hydrodynamics	39 Karhusuontie 39 - 00780 Helsinki - Finland	+358 9 385 59 07	+358 9 345 4002	n.n@wpoy.com
France						
Alstom Hydro Power	Pierre Potier	Sales Manager	2 Quai Michelet - 92309 Levallois-Perret - France	+33 1 41 49 20 14	+33 1 41 37 52	pierre.potierpower.alstom.com
Alstom Hydro Power			82 avenue Léon Blum - 38085 Grenoble Cedex 2 - France	+33 4 7639 3000	+33 4 7639 3001	www.alstom.fr
Basler Electric	Pascale Freyburger	Marketing & Sales Manager	Parc des Pins - 67319 Wasselonne - France	+33 3 8887 1010	+33 8887 0808	pascalefreyburger@basler.com
Bernard & Bonnefond, Z.A.	Michel Paolone	Sales Manager	Plateau des Forges - 42100 Terrenoire - France	+33 4 7795 3000	+33 4 7795 7806	michel.Paolone@bernardbonnefond.com
CETIM	Rodolphe Beaugrand	Sales Executive	74 route de la Jonelière BP 82617 - 44326 Nantes Cedex 2 - France	+33 2 4037 3598	+33 2 5186 4623	tfe@cetim.fr

COMPANY	CONTACT NAME	CONTACT TITLE	ADDRESS	TEL	FAX	WEBSITE / E-MAIL
Clemessy	Clive Norman	Marketing	18 rue de Thann - BP2490 - 68057 Mulhouse Cedex 2 - France	+33 1 61 37 20 61	+33 1 61 37 20 60	c.norman@clemessy.fr
Coyne et Bellier	Marlene Le Bourhis	Marketing Manager	9 Allée des Barbanniers - 92632 Gennevilliers Cedex - France	+33 1 4185 0369	+33 1 4185 0374	marlene.le-bourhis@coyne-et-bellier.com
EDF Generation & Engineering - Hydro Engineering Centre	Frédéric Louis	Head, International Business Development	Savoie Technolac - 73373 Le Bourget du Lac Cedex - France	+33 479 606 218	+33 479 606 229	frederic.louis@edf.fr
Hydroplus	Julien Rayssiguier	Managing Director	5 cours Ferdinand-de-Lesseps - 92851 Rueil-Malmaison Cedex - France	+33 1 4716 4404	+33 1 4716 4212	contact@hydroplus.com
IXSEA	Eric Richaud	Sales Director	55 Avenue Auguste Renoir - 78160 Marly le Roi - France	+33 1 3008 9888	+33 1 3008 8801	info@ixsea.com
MJ2 Technologies	Marc Leclerc	General Manager	1 rue de l'étain ZA Belair - 12850 Onet le Château - France	+33 6 1575 6699		info@vlh-turbine.com
SOGREAH Consultants	Thierry Bongrand	Head, Energy & Dams Division	BP 172 Grenoble 38042 - France	+33 476 334 134	+33 476 334 094	thierry.bongrand@sogreah.fr
SOL Expert International	Gilbert Salvi	CEO	285 Av. George Clemenceau - 9200 Nanterre - France	+33 1 4776 5650	+33 1 4776 5651	gsalvi@solexpert.com
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Annex 3

RISK ASSESSMENT by COFACE

(source: http://www.trading-safely.com/)

ALBANIA

RISK ASSESSMENT

A moderate slowdown in 2009

Economic growth remained strong in 2008 amid buoyant domestic demand, driven by the expansion of credit and expatriate worker remittances, and public sector investment (particularly in roads). Despite the rise of prices for energy and food products, inflation has remained limited, compared to most regional countries. A slight growth slowdown will nonetheless be likely in 2009 due to fallout from the international financial crisis. The moderation of domestic demand is not, however, expected to have a significant impact on the current account, which will remain deeply in deficit as a result of the slowdown of foreign demand.

Noteworthy progress but handicaps still to be overcome

Substantial progress, linked to implementation of public policies, has been made these past years. Productivity has improved markedly. The standard of living and the social situation have improved. Government finances are in better shape now than in the past, although some deterioration of public sector accounts has been apparent since 2008. Reforms affecting the business environment (overhauling the civil service and the legal system, combating corruption and organized crime) have been lagging. That has also been the case with modernizing the energy sector notwithstanding the large energy projects recently agreed with Italy. Despite diversification efforts, exports are still concentrated on textiles, exposed to competition from low cost countries, and dependent on the Italian market. With the growth of bank credit denominated in foreign currency, the exposure of borrowers to exchange rate risk has increased.

Democratic institutions in needs of consolidation

Following the June 2009 parliamentary election, Prime Minister Sali Berisha has forged a coalition and will have a working majority. Nevertheless, implementation of reforms he had promised to carry out has been relegated to the backburner, particularly as regards consolidating the rule of law.

BOSNIA

RISK ASSESSMENT

Gloomier growth prospects

Thanks to a fixed exchange rate and implementation of reforms in important areas like the financial system, the country achieved strong growth in recent years with little inflation. Private consumption spurred by the rise of real wages and a credit expansion drove the economy in 2008. In 2009 infrastructure investment will likely buoy construction and consumption is only expected to slow moderately. A marked economic slowdown is nonetheless forecast due to the contraction of export markets, the rise of interest rates, and limited access to financing. The remittances from migrant workers on which the country is very dependent will likely suffer amid the slowdown affecting Western economies.

Greater imbalances

The stimulatory fiscal policy pursued by the government, strong domestic demand, and higher prices for energy and food products have been accompanied by a disquieting increase in the current account deficit that could prove difficult to cover in the current context. Even with imports now trending down, they will continue to outstrip exports by a wide margin. Although strengthened by productivity gains, sales abroad still lack diversification (with basic metals, mineral products, and wood representing nearly half of total exports) and remain dependent on world price trends. Achieving more balanced and stronger growth will depend on progress on structural reforms including corporate restructuring and privatization, improvement in the business environment, reduction of taxes on labor, and tax reform.

A still weak political and institutional context

Despite the Stabilization and Association Agreement concluded with the European Union in June 2008, political risk has remained high with the country continuing to suffer from extensive institutional and ethnic fragmentation. Necessary structural changes, especially at the constitutional level, could again meet with delays.

MACEDONIA

RISK ASSESSMENT

Strong growth thus far but with deterioration of external accounts

Driven by domestic demand, the economy remained strong for most of 2008 with imports growing strongly due to increased spending on oil and on capital and consumer goods. And the increase in exports of metal (40 per cent of the total) and food products was not enough to offset that trend while remittances from expatriate workers proved very volatile. The current account deficit has reached high levels. Despite the rise of foreign direct investment, foreign exchange reserves have stagnated.

Despite improvement in the business environment and the prospect of admission to the European Union, the world economic slowdown and increasing scarcity of foreign capital will likely undermine GDP growth in 2009. The current account deficit is not expected to improve much and that will constitute a major element of weakness in the current context and could put pressure on the exchange rate regime based on a denar pegged to the euro.

Growth of foreign debt and a loosening of fiscal policy

Foreign debt has begun to grow again fuelled by a private sector that has moreover taken on heavy foreign-currency debt in the domestic market. The government's economic stimulus program and infrastructure modernization will likely cause the public sector deficit to widen further in 2009. The size of government debt, which has declined sharply in recent years as a result of early repayments to the London and Paris Clubs, is thus expected to level off.

A precarious political situation

The conservative VMRO-DPMNE party won re-election in the June 2008 legislative elections. It has joined forces with the country's largest Albanian party and the resulting coalition controls in principle enough votes to win adoption of reforms considered the most controversial from an ethnic standpoint. Violence marred the elections, however, and relations between the two main Albanian parties have deteriorated. The veto by Greece on Macedonia joining NATO has, meanwhile, strained diplomatic relations between the two countries.

MONTENEGRO

RISK ASSESSMENT

Growth driven mainly by foreign investment and tourism

Economic growth continued at a good clip in 2008 thanks to investments that fuelled property construction and services. Wage increases and the rise of energy prices, meanwhile, stoked inflation even with the use of the euro limiting the pressure on prices. And the international crisis is not expected to spare the economy in 2009 with the impact of the drop in prices for aluminum – 60°per°cent of exports and 14°per°cent of GDP – compounded by the effects of the decline in capital flows and the slowdown of tourism. Further out, the country seeks to specialize in high-end tourism. Despite the launch of large projects like the transformation of the Tivat naval base into tourist resort under the aegis of the European Bank for Reconstruction and Development, road, airport, and water-recycling infrastructure is still inadequate.

A massive current account deficit

The current account deficit reached record proportions in 2008, swelled by an import surge, itself fuelled by wage growth, bank credit expansion, booming construction, and increasing energy costs. Despite the economic slowdown and the decline in oil prices expected in 2009, the imbalance will remain at difficult-to-sustain levels. Foreign direct investment focused mainly on property has, to a large extent, covered the deficit in recent years, but could decline in the current period of crisis. Prudent public sector financial management has, however, at least avoided exacerbating the situation.

European Union: a remote prospect

Former Prime minister Milo Djukanovic came back on the scene in February 2008, strengthening the dominant position of a Socialist Democratic Party favored to win the elections in 2009 against a divided opposition. Although Montenegro submitted its candidacy to the European Union in December 2008, it is still far from meeting membership criteria, particularly on combating corruption and organized crime and modernizing the civil service.

SERBIA

RISK ASSESSMENT

Growth likely to weaken significantly

After a period of strong expansion fuelled by wage and credit growth, the economy is expected to weaken markedly amid the increasing scarcity of foreign financing and deteriorating world economic conditions. The upturn of domestic interest rates and the still high level of inflation will tend to undermine domestic demand. According to Coface records, payment defaults by Serbian companies are relatively rare. The agrochemical, information technology, and electronics sectors are expected to cope with the slowdown more effectively than will construction, and, à fortiori, two already weakened sectors, heavy industry and textiles.

Economic growth continues to rest on structurally weak foundations. Widening external deficits have apparently not helped finance a private investment boom apt to improve domestic supply capacity and strengthen exports. The productive sector remains handicapped by slow and irregular progress on privatization and a difficult business environment, efforts to establish a framework conducive to investment notwithstanding.

Lax fiscal policy and high exchange rate risk

Despite a sharp reduction in government debt in recent years as a result of debt relief and early repayments, the fiscal laxity apparent since 2006 has been a source of concern to the IMF with which Serbia just concluded an agreement (November 2008). The Fund has recommended with insistence that the government reduce public spending.

The dinar came under great pressure in October 2008, forcing the central bank to repeatedly intervene in the foreign exchange market and raise its key interest rate. The currency has nonetheless remained very weak with Serbia excessively dependent on foreign capital to meet its large external financing needs. And the growth of those needs is no longer offset by commensurate increases in foreign direct investment just when international bank financing is becoming increasingly scarce in the context of the world financial crisis. The impact of an exchange rate crisis would be all the more brutal with domestic debt highly "euro-ized" and companies having substantially increased their indebtedness abroad. The rapid expansion of credit and the extent of loans denominated in foreign currencies constitute other sources of vulnerability for a nonetheless reasonably well capitalized banking system.

But an improving political context

The pro-European coalition's victory in the May 2008 parliamentary elections paved the way for rapprochement with the European Union, sealed by the conclusion of a Stabilization and Association Agreement. Neither the Serbian people nor government officials seem willing to sacrifice an opportunity to open the economy and normalize the country's international relations for the sake of intransigence on Kosovo, which proclaimed its independence in February 2008.

Annex 4

COUNTRY RATING

(source: http://www.trading-safely.com/)

COUNTRY RATING

ALBANIA

Country Rating: D

A high-risk political and economic situation and an often very difficult business environment can have a very significant impact on corporate payment behaviour. Corporate default probability is very high.

Business Climate Rating : C

The business environment is difficult. Corporate financial information is often unavailable and when available often unreliable. Debt collection is unpredictable. The institutional framework has many troublesome weaknesses. Intercompany transactions run major risks in the difficult environments rated C.

BOSNIA

Country Rating : D

A high-risk political and economic situation and an often very difficult business environment can have a very significant impact on corporate payment behavior. Corporate default probability is very high.

Business Climate Rating : C

The business environment is difficult. Corporate financial information is often unavailable and when available often unreliable. Debt collection is unpredictable. The institutional framework has many troublesome weaknesses. Intercompany transactions run major risks in the difficult environments rated C.

MACEDONIA

Country Rating : C

A very uncertain political and economic outlook and a business environment with many troublesome weaknesses can have a significant impact on corporate payment behavior. Corporate default probability is high.

Business Climate Rating : C

The business environment is difficult. Corporate financial information is often unavailable and when available often unreliable. Debt collection is unpredictable. The institutional framework has many troublesome weaknesses. Intercompany transactions run major risks in the difficult environments rated C.

SERBIA

Rating : C

A very uncertain political and economic outlook and a business environment with many troublesome weaknesses can have a significant impact on corporate payment behavior. Corporate default probability is high.

Business Climate Rating : C

The business environment is difficult. Corporate financial information is often unavailable and when available often unreliable. Debt collection is unpredictable. The institutional framework has many troublesome weaknesses. Intercompany transactions run major risks in the difficult environments rated C.

Annex 5

MAJOR MACRO ECONOMIC INDICATORS

(source: http://www.trading-safely.com/)

MAJOR MACRO ECONOMIC INDICATORS

ALBANIA

(USD millions)	2004	2005	2006	2007	2008(e)	2009(f)
Economic growth (%)	5.9	5.5	5.0	6.0	6.0	4.0
Inflation (%)	2.3	2.4	2.4	2.9	3.5	3.0
Public sector balance (%GDP)	-5.2	-3.7	-3.2	-3.3	-5.5	-5.2
Exports	603	656	793	1,076	1,351	1,363
Imports	2,195	2,478	2,916	3,999	4,753	4,690
Trade balance	-1,592	-1,821	-2,123	-2,923	-3,402	-3,327
Current account balance (%GDP)	-4.8	-6.8	-7.3	-10.7	-12.9	-13.5
Foreign debt (%GDP)	20.8	21.0	19.8	18.3	19.7	23.3
Debt service (%Exports)	2.5	2.5	3.7	3.5	4.5	4.5
Foreign exchange reserves (in months of imports)	5.0	4.3	4.6	4.2	3.9	4.2

(e) estimate (f) forecast

BOSNIA

(USD millions)	2005	2006	2007	2008	2009 (f)	2010 (f)
Economic growth (%)	3.9	6.9	6.8	5.5	-3.0	0.5
Inflation (%)	3.6	6.1	1.5	7.4	1.6	2.3
Public sector balance (%GDP)(*)	-2.2	-0.4	-3.3	-6.1	-7.0	-7.0
Exports	2 555	3 381	4 243	5 079	3 554	3 840
Imports	7 454	7 680	9 947	12 139	8 680	9 189
Trade balance	-4 899	-4 298	-5 704	-7 060	-5 125	-5 349
Current account balance (%GDP)	-17.1	-7.9	-12.8	-14.7	-9.7	-9.6
Foreign debt (%GDP)	51.3	47.9	47.5	44.5	52.4	56.7
Debt service (%Exports)	5.3	6.9	4.9	5.1	7.0	7.7
Foreign exchange reserves (in months of imports)	3.7	4.8	4.9	3.2	3.7	3.6

(*) ex grants (e) estimate (f) forecast

MACEDONIA

(USD millions)	2004	2005	2006	2007	2008(e)	2009(f)
Economic growth (%)	4.1	4.1	4.0	5.0	5.5	4.0
Inflation (%)	-0.4	0.5	3.2	2.3	8.5	3.0
Public sector balance (%GDP)	0.0	0.2	-0.5	0.6	-1.5	-3.0
Exports	1,675	2,041	2,396	3,349	4,394	4,226
Imports	2,814	3,104	3,681	4,979	6,994	6,731
Trade balance	-1,139	-1,063	-1,285	-1,630	-2,600	-2,505
Current account balance (%GDP)	-8.4	-2.7	-0.9	-7.8	-14.0	-13.3
Foreign debt (%GDP)	52.5	51.1	51.9	51.8	50.2	58.1
Debt service (%Exports)	14.6	12.7	15.6	22.9	21.1	25.0
Foreign exchange reserves (in months of imports)	3.2	3.9	4.8	4.2	2.8	2.7

(e) estimate (f) forecast

SERBIA

(USD millions)	2005	2006	2007	2008	2009 (f)	2010 (f)
Economic growth (%)	5.6	5.2	6.9	5.4	-4.0	0.5
Inflation (%)	17.3	12.7	6.5	11.7	9.7	6.4
Public sector balance (%GDP)	0.8	-1.6	-1.9	-2.5	-3.5	-2.5
Exports	4 970	6 442	8 756	10 957	9 971	10 968
Imports	10 260	12 713	17 886	22 213	18 215	18 907
Trade balance	-5 290	-6 271	-9 130	-11 256	-8 244	-7 939
Current account balance (%GDP)	-2 226	-3 967	-6 334	-8 731	-4 671	-4 278
Foreign debt (%GDP)	-8.8	-13.5	-15.7	-17.5	-11.4	-9.8
Debt service (%Exports)	61.1	66.5	64.8	60.7	78.3	85.7
Foreign exchange reserves (in months of imports)	8.9	22.9	27.1	31.4	41.4	34.7
	5.3	8.4	7.3	4.7	5.4	5.7

(e) estimate (f) forecast