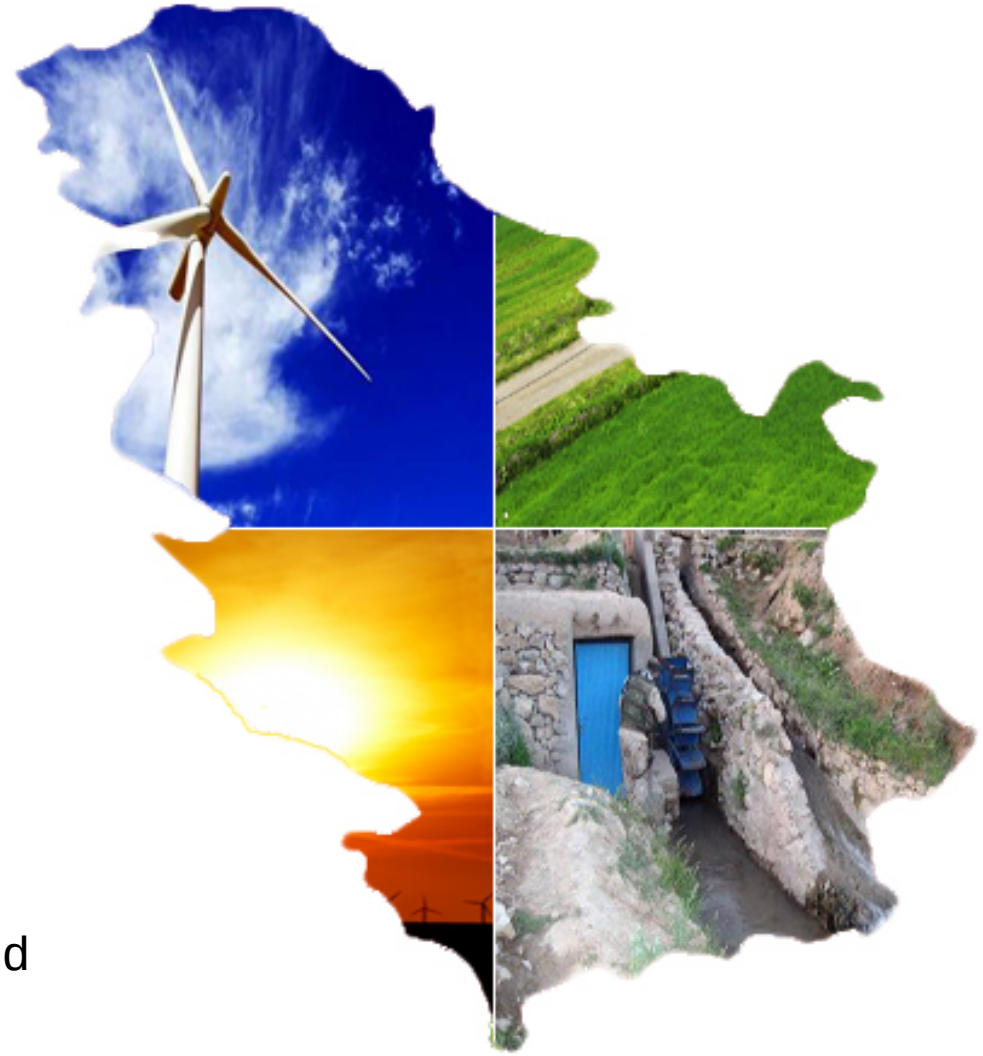


Serbia

Renewable
Energy
Sources

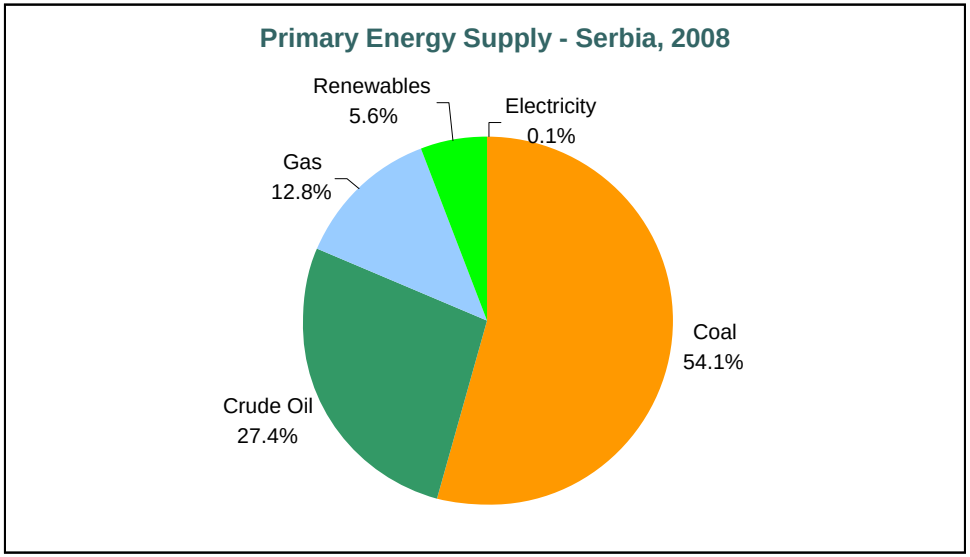
Technical and
Market
Potential

Republic of Serbia – Ministry of Mining and Energy
Athens, May 2008.

Energy Indicators

Energy Balance of Republic of Serbia, 2008

	2007 (estimation, Mtoe)
National production	**8.796**
Import	**6.139**
PRIMARY ENERGY SUPPLY	**14.825**
Industry	**2.675**
Transport	**1.923**
Households	**3.024**
FINAL ENERGY CONSUMPTION	**7.622**



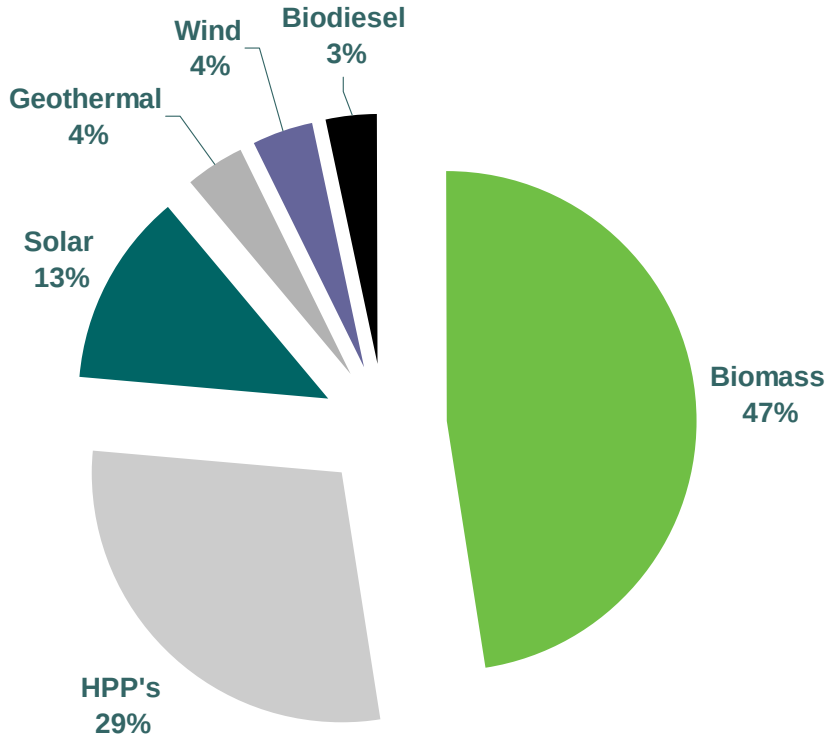
final energy consumption **3.5%** ↗

primary energy supply per capita **1.9%** ↗

RES Technical Potential

Serbia's endowment of renewable energy resources is substantial
- realization of these potentials require Government action

	Potentials (Mtoe)
Biomass	2.40
HPP's	1.46
Solar	0.64
Geothermal	0.20
Wind	0.19
Biodiesel	0.17
TOTAL	5.06



Clear technical potential of renewable energy - insufficient information about the economic potential (four detailed feasibility studies)

Biomass

Wood biomass

1 Mtoe

Agriculture biomass

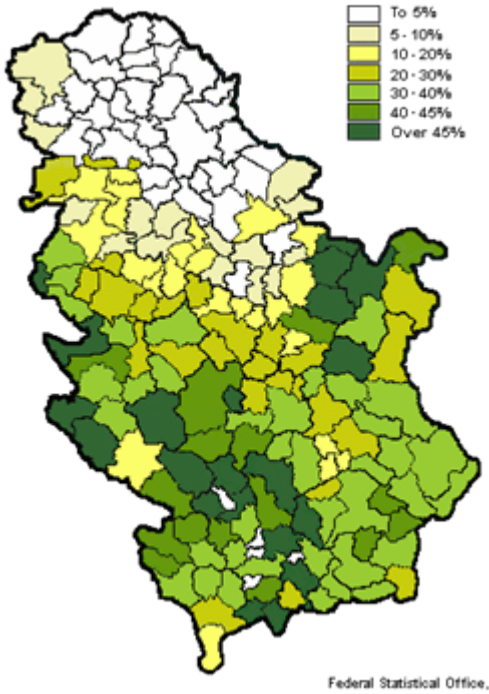
1.4 Mtoe

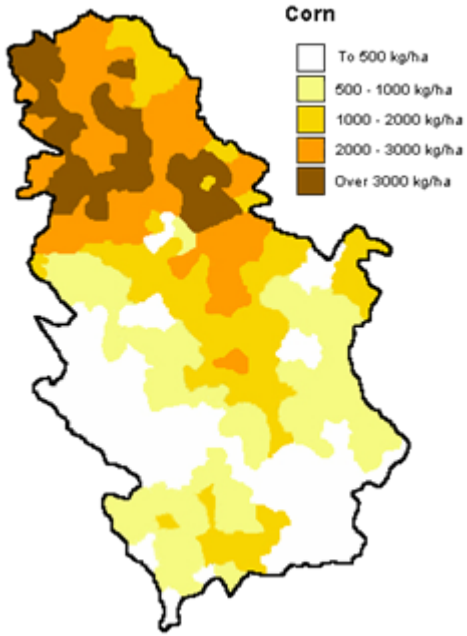
Most promising utilization options for biomass:

•Space heating in households and buildings using biomass pellets or briquettes

•Co-firing or total replacement in district heating plants firing heavy oil or coal in south Serbia, where natural gas is not available yet

•Production of electricity utilizing agricultural and wood wastes





BIOMASS MARKET POTENTIAL

2.4 Mtoe => converted to thermal energy
Cost - 4.1 €/GJ

411.9 M €

Hydro

Small hydro

SHPP Cadastre (1987)
856 locations
500 MW

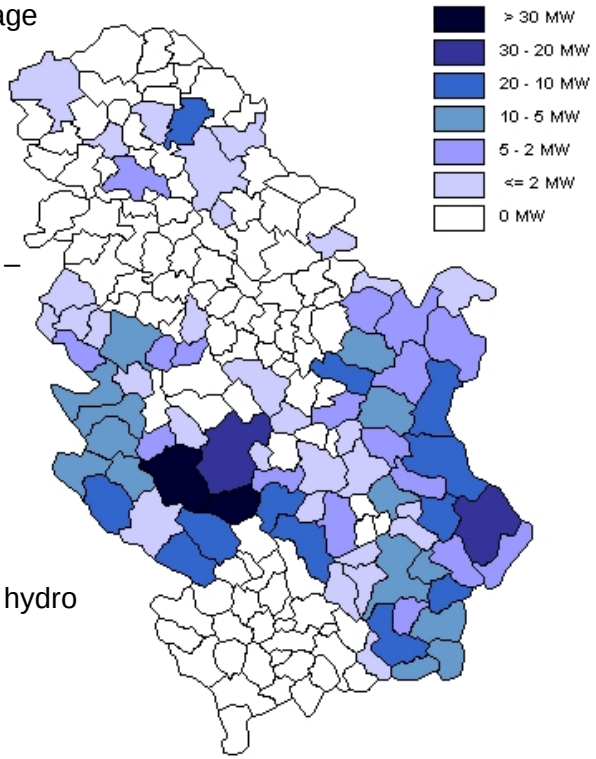
>5 MW: 9 locations
2-5MW: 30 locations (average 3 MW)
<1 MW :largest number of locations

1,500 GWh/year

Number of SHPP in Serbia – 60
(50% out of operation)

Revitalization

Construction



Medium and large-scale hydro

1987. survey - 47 medium sized hydro

between 10 and 100 MW

1,247 MW

SHPP MARKET POTENTIAL

With average current price of electricity 5 €c/kWh

75 M €

With feed-in-tariffs for SHPP of 6 €c/kWh

90 M €

MEDIUM AND LARGE-SCALE HYDRO MARKET POTENTIAL

With average current price of electricity 5 €c/kWh

240.3 M €

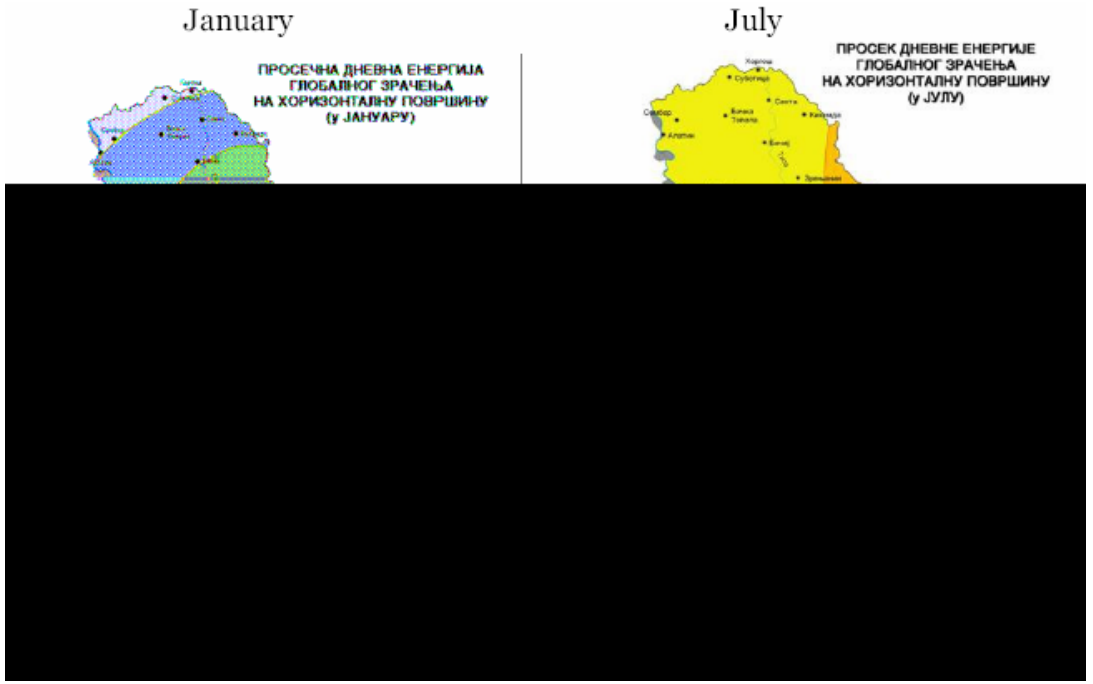
Solar

Average yearly insolation in Serbia
about 1,400 kWh/m²

Average daily value
about 3.8 kWh/m²

If each housing unit (2.65 million units) would install average 4 m² of collectors

Equivalent to some saving potential of
7,420 GWh
or
371 M €



Geothermal

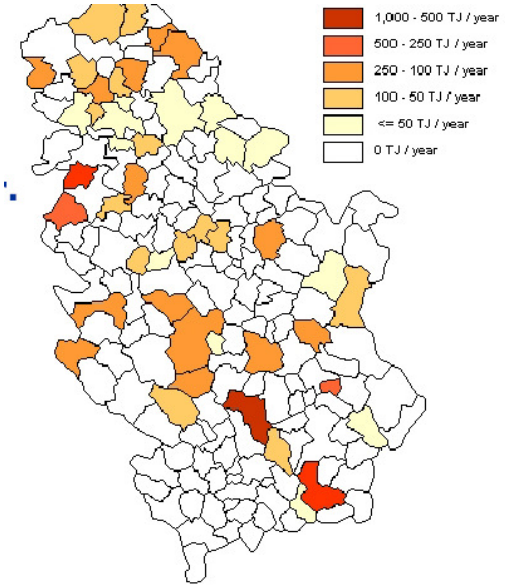
Use of geothermal potential is mainly for balneological purposes, sports and recreation

Total installed energy use - 74 MWt

36 MWt in balneology
38 MWt for other types of uses

Prospects for expanding geothermal energy for agricultural heat and water heating are reasonably good

Potential for larger scale geothermal electricity is limited - requires water temperatures above 100°C.



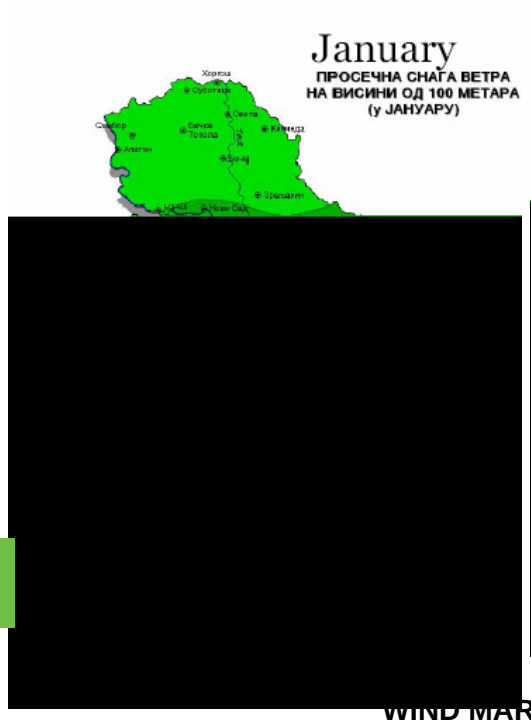
Wind

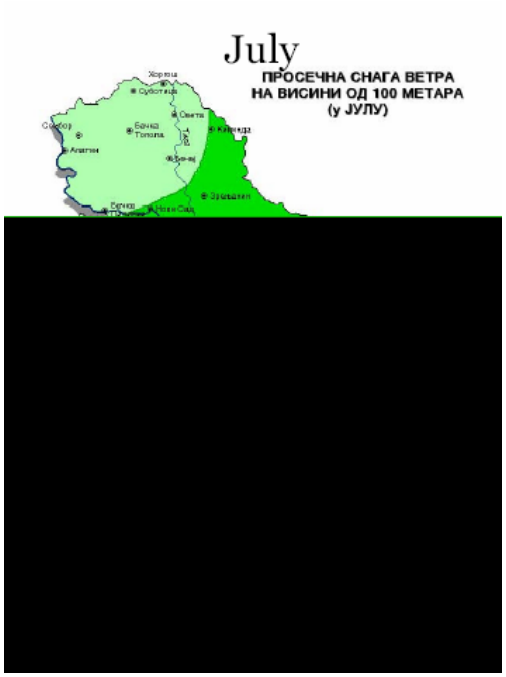
Wind data
based on 10 metre heights
extrapolated to 50 metre heights

2,300 GWh

1,300 MW of capacity

at sites with minimal average wind speeds of 5 m/s





Best locations in Serbia (extrapolated)	
Midzor	7.66 m/s
Suva Mt.	6.46 m/s
Vrsacki breg	6.27 m/s
Tupiznica	6.25 m/s
Krepoljin	6.18 m/s
Deli Jovan	6.13 m/s

WIND MARKET POTENTIAL

With average current price of electricity 5 €c/kWh

115 M €

With feed-in-tariffs for SHPP of 7.5 €c/kWh

172.5 M €

Biodiesel

Potential for growing rapeseed for production of biodiesel - in central Serbia

Annual production of 440,000 – 500,000 tones of rapeseed possible on 200,000 hectares

Potential for the production of biodiesel - estimated to 200,000 tones per year or 10.5% of consumption of diesel fuels in Serbia

BIODIESEL MARKET POTENTIAL

200,000 tones => 172,000 toe

200,000 tones => 233.8 M litres

Average retail price of biodiesel in 2007.
Serbia 63.8 RSD/lit => 0.77 €/lit

180 M €

RES Market Potential

	Used potential (Mtoe)	Used potential (%)
Biomass	0	0.0%
HPP's	0.84	57.5%
Solar	0	0.0%
Geothermal	0	0.0%
Wind	0	0.0%
Biodiesel	0	0.0%
TOTAL	0.84	16.6%

	With average price of electricity of 5 €c/kWh *(in M €)*	With feed-in tariffs *(in M €)*
Biomass (for heating)	411.9	411.9
SHPP's	75	90
Medium and Large HPP's	240.3	240.3
Wind	115	172.5
Biodiesel	180	180
TOTAL	1,022.2	1,094.7

POTENTIAL FOR SAVING USING SOLAR THERMAL
With average current price of electricity 5 €c/kWh

371 M

Barriers for wider use of RES

Institutional barriers

•Promotional entity

Serbian Energy Efficiency Agency is designated by the Government to promote energy efficiency and renewable energy, but the level of staffing is inadequate

•The Concession Law

The Concession Law is applicable to the public tender procedure for the construction of energy facilities, but the concession-granting procedure is rather complex

•Absence of Standardized Power Purchase Agreement

For renewable energy producers

•Lack of experience

Need for the experience of how a private sector renewable energy project can work in Serbia

Absence of "first set" of projects

•Transition Issues

Many industrial companies are in transition – both with regard to structure and ownership, and managements are not yet ready to consider measures to rationalize energy activities

Barriers for wider use of RES

Financial barriers

•Absence of a price support mechanism

Renewable energy projects are not bankable without a price support mechanism

RES cannot compete with fossil electricity generation based on lignite (whose price does not reflect their environmental damage costs)

•Debt Financing support

Difficulty to secure long term loans appropriate for small renewable energy projects

•Electricity tariff

Low electricity tariff does not stipulate domestic, commercial and industrial consumers to use renewable energy - current average price is 5 €cents/kWh

Barriers for wider use of RES

Technical barriers

•Absence of technical standards

Despite the existence of manufacturers of heating equipment and biomass fuel (briquettes and pellets), production standards are not regulated

Equipment for biomass energy utilization need clear information about technical specification and performance characteristics

•Barriers to biomass utilization

Low electricity price, which decrease motivation to install biomass firing boilers

No developed market for biomass fuel and biomass utilisation facilities

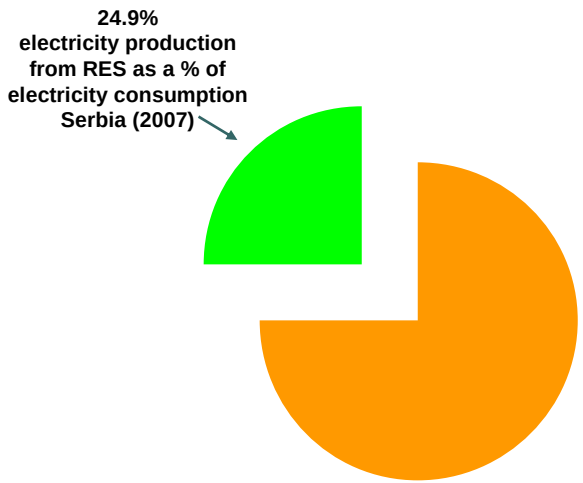
•Absence of a renewable energy resources inventory

Update and development of Small Hydro Registry

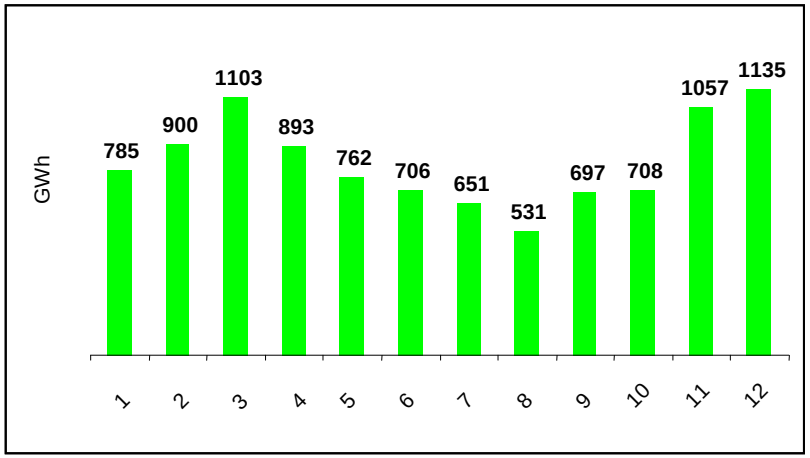
Wind monitoring programme with wind speed measurements at 50 metres needed

Recent developments

Electricity generation from RES in 2007 – 9,928 GWh



Monthly electricity generation from renewables Serbia (2007)



Elekroprivreda Srbije (EPS) and Elektroprivreda Republike Srpske (EPRS) founded joint venture company in Bosnia and Herzegovina to conduct a detailed feasibility study for the exploitation of unused hydro potential of Drina river. Estimations are that new 800 MW of installed capacity could be developed on Drina river.

Private investors currently conducting wind measurements at four locations in Serbia, to assess potential for development of wind power facilities in Pancevo (20 MW), Vrsac (100 MW), Indjija (20 MW) and Kovin (100 MW)

Spanish Government signed an agreement with the Government of Serbia on cooperation in developing wind power. Three sites are chosen for a one-year measurement program and one site will be chosen for the preparation of detailed feasibility study.

Legal regulation under preparation

Purpose: to promote investments in renewable energy projects

Amendments to the Energy Law
drafted, waiting for adoption by the Parliament

•Production, transporting, storaging and trading of biofules is recognized as energy activity

•Definition of renewable energy sources is amplified and contains biofuels, biogas, landfill gas, sewage gas

•Definition of biomass reffer to biodegradable material developed in agriculture, forestry and accompanying industry for energy purposes

•Definition of privileged power producers includes all RES producers except hydro-power plants and biomass power plants larger than 10 MW

•Privileged power producers need Government approval for export of power

•Guaranteed grid access to a privileged power producers - through obligation of local distribution company to purchase all the electricity produced from RES

•Foundation of Energy Efficiency Fund

Regulation on privileged power producers will be the definition of what types of renewable energy producers qualify for privileged status and will be drafted with technical support of EAR

Deadline for completion: December 2008
Deadline for adoption: 1 July 2009.

Feed-in tariffs as the price support mechanism will be developed with technical support of EAR

Deadline for completion: December 2008.
Deadline for adoption: 1 July 2009.

Standardized power purchase agreement will be drafted with technical support of EAR, for all qualifying renewable energy facilities that meets the technical standards of the grid code

Deadline for completion: December 2008.
Deadline for adoption: 1 July 2009.

Identified priorities

Rehabilitation of existing hydro plants to extend their operating life has potential to generate more electricity from the existing facilities

Biogas needs to be studied to identify which locations have sufficient potential to constitute viable projects. Biogas projects are particularly attractive for carbon finance, because of the high global warming potential of methane.

Economic and financial portions of studies on biomass combustion need to be redone, to compare alternatives and examine the question of the present pricing of heat, in a form suitable for private sector project financing.

In the area of small hydro MoME is undertaking feasibility studies - funded by EAR - for 21 location larger than 2 MW. Tender for granting concessions on SHPP – launched in 2009.

MoME and Serbian Investments and Export Promoting Agency (SIEPA) are preparing a handbook for developers of SHPP that provides a detailed roadmap for obtaining all of the required permits. Deadline for completion: May 2008.

Wind resource development should be extended to include multi-year wind speed monitoring at 50 metre heights for 5-8 additional sites.

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