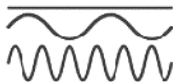


Energy Sector of the Republic of Macedonia

**Partnership Program
(ERC, R. Macedonia – PSB, Vermont)
Skopje, March 20-26, 2004**

Energy Sector of the
Republic of Macedonia

ELECTRICITY



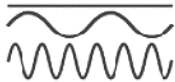
- **Power System Infrastructure**

- Production, transmission and distribution of electric power in Macedonia are performed by the Macedonian power utility, Elektrostopanstvo na Makedonija (ESM).
- ESM is vertically integrated public utility which includes:
 - 7 electric power generating branches
 - One power transmission branch
 - 28 power distribution branch

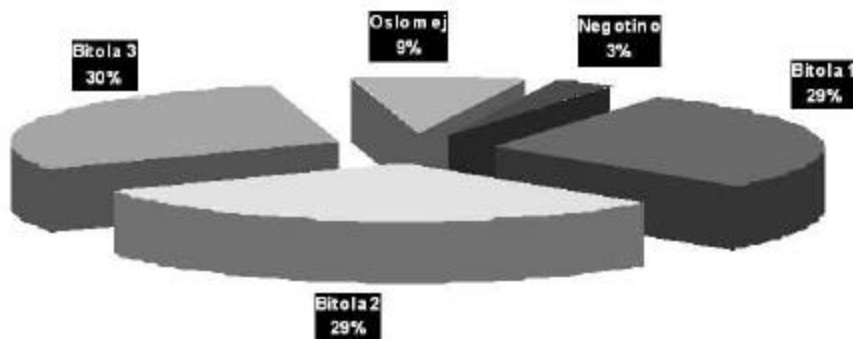
Generation Capacities

- Thermal Power Plants

	Nominal power (MW)	Net.Prod. 2002 (GWh)	Year of installation	Operation hour 2002	Mean fuel	Fuel energy value (kJ/kg)
Bitola 1	225	1389,4	1982	7750	lignite	7908
Bitola 2	225	1472,9	1984	7750,23	lignite	7908
Bitola 3	225	1435,4	1988	7252,54	lignite	7908
Oslomej	125	416,8	1980	6465,1	lignite	7667
Negotino	210	148,8	1978	7836	fuel oil	40190
Total	1010	4863,4				



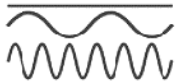
- Capacity structure by thermal power plant



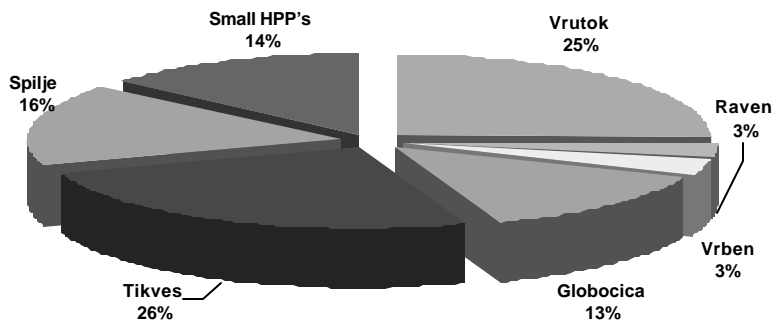
Generation Capacities

- Hydro Power Plants

	Number of units	Nominal power (MW)	Net.Prod. 2002 (GWh)	Year of installation	Plant type	Reservoir volume (10 ⁶ m ³)
Vrutok	4	150	190,1	1957/1973	reservoir	277
Raven	3	19,2	21,2	1959/1973	run of river	
Vrben	2	12,8	25,6	1959	run of river	
Globocica	2	42	99,4	1965	reservoir	15
Tikves	4	92	193,2	1968/1981	reservoir	272
Spilje	3	84	122,7	1970	reservoir	212
Small HPP's	22	35,8	103,2	1938-1993	river./reser.	115
Kozjak (under const.)	2	80			reservoir	260
Total	42	513,8	755,4			

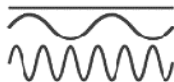


- Capacity structure by hydro power plant



Under Construction/Planned Power Plants

Year	Total System Net Capacity [MW]	Capacity additions
2001	1444.0	(80.5 MW Kozjak)
2004	1618.0	174 MW Cogeneration plant in Skopje
2006	1740.0	122 MW Gas turbine
2010	1814.0	Storage Lukovo Pole, 72.8 MW Spilje2
2011	2033.0	219 MW CCGT
2013	2045.0	219 MW CCGT
2014	2248.0	203 MW Bitola 4 (import lignite) 203 MW Bitola 1 (rebuild)
2015	2317.0	45 MW Boskov Most, 33.2 MW Matka 2
2016	2420.0	203 MW Imported Coal
2018	2420.0	207 MW Bitola 2 (rebuild)
2019	2474.0	54.6 MW Gradec
2020	2681.0	207 MW Bitola 3 (rebuild)

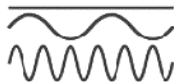


Power System Infrastructure

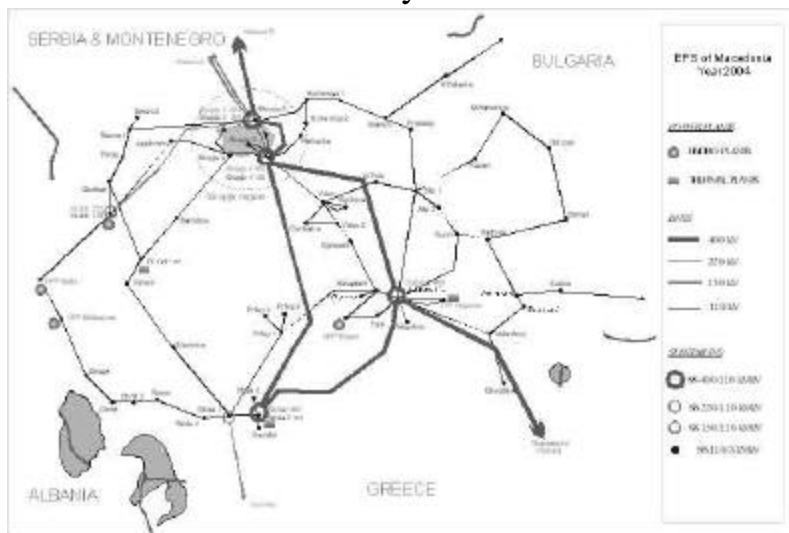


Transmission System

Overhead lines	400kV	220kV	150kV	110kV	Total
Length [km] (miles)	371.2 (230.7)	166.5 (103.46)	22.4 (13.9)	1387.7 (862.3)	1947.8 (1210.3)
Substations	400/100 kV/kV	220/110 kV/kV	150/110 kV/kV	110/x kV/kV	Total
No. of substations	3	1	1	8	13
No. of Transform.	6	3	2	20	31
Installed power [MVA]	1800	450	100	487.5	2828.5

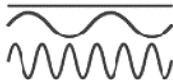


Transmission System - 2004



Interconnections with systems of neighboring countries

Current interconnections		
Neighboring Country	Voltage level	Nominal Capacity
Serbia	400kV	1200 MW
Kosovo	2x220kV	300 MW
Greece	150 kV, 400kV	1200 MW



Under Construction/Planned Interconnections

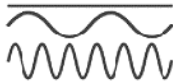
- Interconnection 400 kV line, Bitola (Macedonia) – Florina (Greece), upgrading the existing 150 kV line to 400 kV
- Total length: 40 km
 - On Macedonia territory: 18 km
 - On Greek territory: 22 km
- Total costs: \$ 9.500.000
 - Total costs of Macedonian part: \$ 4.500.000



Under Construction/Planned Interconnections

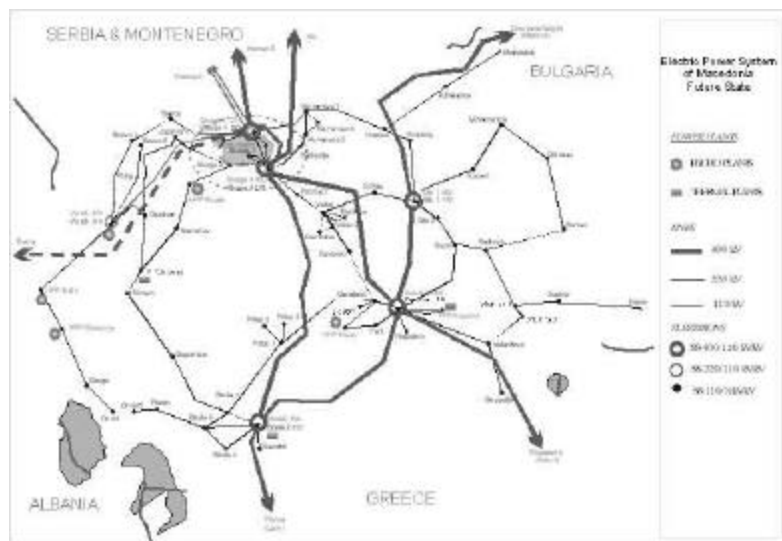
- Interconnection 400 kV line Macedonia-Bulgaria, Dubrovo – Stip –Chervena Mogila
- Exchange of 600 MW
- Total length on Macedonian territory: 190 km
 - Dubrovo - Stip: 40 km
 - Stip - Deve Bair(Gjuesevo): 70 km
 - Chervena Mogila(Radomir) – Gjusevo (Deve Bair): 80 km
- Total costs: \$ 55.500.000
 - Total costs of Macedonian part: \$ 35.270.000

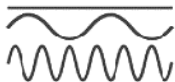




Under Construction/Planned Interconnections

- Interconnection 220 kV line Macedonia - Albania, Vrutok – Burelli
- Exchange of 50-150 MW
- Total length: 104 km
 - Vrutok - Macedonian border: 48 km
 - Macedonian border – Burelli – 56 km
- Total costs: \$ 12.680.000
 - Total costs of Macedonian part: \$ 5.860.000





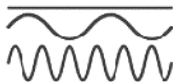
Distribution System

Distribution lines	110kV	35kV	20kV	10kV	0.4kV	Total
Overhead [km]	270.8	877.2	487.0	6374.0	9781.0	17790.0
Underground [km]	–	55.6	243.5	1497.0	1863.0	3659.1
Total	270.8	932.8	730.5	7871.0	11644.0	21449.1

Transformers Substations	No. of transformers	Installed power [MVA]
110x/y	73	1880.8
35/20	2	8.0
35/10	144	716.2
35/6	2	8.0
20/0.4	540	185.0
10/0.4	5222	1644.0
6/0.4	14	7.6
Total	5997	4449.6

Energy Sector of the Republic of Macedonia

COAL



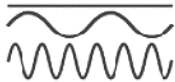
- Coal

- Lignite represents the only fossil resource presently exploited in Macedonia.
- 4 coal mines, 2 state-owned, 2 privately owned

Mines	Explored Reserves [Mil. Tons]	Heating value [kJ/kg]	Average yearly production [Mil. Tons]	Usage	Start year	Available reserves to
Suvodol	91	8000	6.30	Electricity generation - TPP Bitola	1982	2014
Oslomej	14	6600	1.05	Electricity generation - TPP Oslomej	1980	2012
RIK Berovo	2	8370	0.08	Industry purposes and house heating	1986	2010
Piskupstina	3.8	10460	0.10	Industry purposes and house heating	1988	2026

Small scale lignite reserves

Lignite deposit	Proven, probable and possible reserves [Mil. Tons]	Heating value [kJ/kg]
Brod-Gneotino (Bitola)	106	8370
Zivojno (Bitola)	100	8370
Zvegor-Stamer (Berovo-Delcevo)	20	7110
Istevnik (Delcevo)	20	7110
Lavci (Resen)	20	6700
Strogomiste (Kicevo)	7	6700
Popovjani (Kicevo)	11	6700
Vitoliste (Prilep)	110	6700
Pelagonija (Bitola)	1500	6700
Pelagonija (Prilep)	77	6700



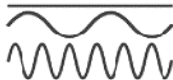
Energy Sector of the Republic of Macedonia

LIQUID FUELS

Generating capacities

- OKTA: Crude oil refinery operating since 1982.
 - Hydro-skimming plant
 - Has capacity of 2.5 million tons.

Derives	%
Motor gasoline	19.2
Diesel guel	34.7
LPG	2.0
Mazut	39.5
Other	2.0

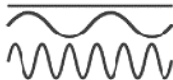


Generation Capacities

Derives	%	Installed capacity [tons]
Motor gasoline -86	3.42	85.500
Motor petrol-98	15.67	391.750
Unleaded motor gasoline -95	0.42	10.500
Diesel fuel D-1	10.83	270.750
Diesel fuel D-2	10.50	262.500
Extra light oil EL	8.33	208.250
Light oil	37.50	937.500
Medium oil	2.67	66.750
Jet fuel GM-1	0.67	16.750
Liquid oil gas	2.08	52.000
Other	7.91	197.750
Total	100	2.500.000

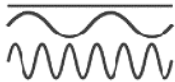
Oil pipeline

Thessaloniki - Skopje				
Length [km]	On Macedonian side [km]	Stations	Capacity [mil. tons]	Year of operation
212.6	143.5	12	2.5	2002
AMBO Pipeline (Bourgas-Vlore) – planned				
Length [km]	On Macedonian side [km]	Stations	Capacity [mil. tons]	Year of operation
920	320		40	



Energy Sector of the Republic of Macedonia

NATURAL GAS

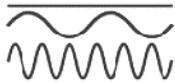


Gas Pipeline

- Total consumption of natural gas was 97 million m³ in 2002
- Gas is imported from Russia since 1997, via pipeline from Ukraine-Moldavia-Romania-Bulgaria
- The pipeline capacity is 800 million m³/a.

	Length [km]	Capacity [mil. m ³]
Kriva Palanka – Skopje	120	800
Klecevce -Negotino -planned	101	400
To Tetovo-Gostivar-planned	65	100
To Kosovo -planned	25	400



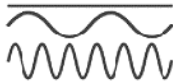


Energy Sector of the Republic of Macedonia

GEOHERMAL ENERGY

Geothermal Energy

- The existing thermal capacity is about 74.5 MWt and the proven thermal potential is estimated to be 220 MWt.
- The geothermal share in the total energy consumption is 0.5%.
- No electricity is produced from geothermal energy.
- Geothermal water is used for heating greenhouses, residential houses, some commercial buildings, swimming pools and in balneology.



Geothermal Zones

- Kocani geothermal zone: since 1982 geothermal heat has supplied 18 hectare of greenhouses and a rice-drying plant.
 - Field Podlog: 22 wells with a depth of 70-350 m; total field productivity 600 l/s with temperatures from 57 to 79°C; used in paper industry, factory for vehicle parts production and heating of dwellings.
- Gevgelija geothermal zone:
 - Field Smokvica: 22 wells with a depth of 30-850 m; total discharge of thermal water was 180 l/s; the average wellhead temperature was 65 °C;
 - Field Negorska Banja: total discharge of thermal water of 80 l/s at 51°C; supplying the hotel complex with energy for central heating, sanitary and balneological purposes.
- Strumica geothermal zone:
 - Field Banjsko: one well with temperature of 65 °C; the thermal water is used for heating glass covered greenhouses and for heat supply of hotels.
- Vinica geothermal zone:
 - Field Vinica: geothermal energy of 14160 kWh annually is used for heating of 6 ha glasshouses.

