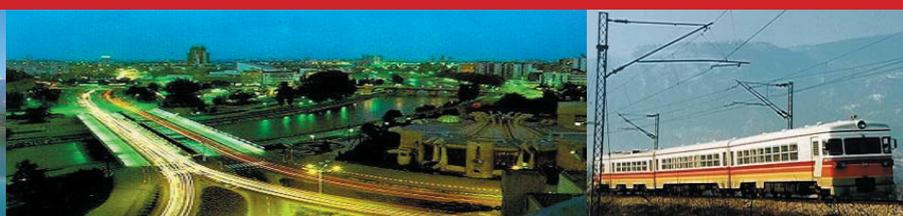




FYR of MACEDONIA

Regular Review of Energy Efficiency Policies 2006



**Energy Charter Protocol on Energy Efficiency and
Related Environmental Aspects PEERA**

Republic of Macedonia¹

REGULAR REVIEW 2006

Part I:

**Trends in energy and energy efficiency policies,
instruments and actors**

¹ The State to which this report relates has been admitted to membership of the United Nations under General Assembly Resolution 47/225 as the Former Yugoslav Republic of Macedonia.

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0. EXECUTIVE SUMMARY

The Republic of Macedonia has been an independent country since 1991. It is also a country with its economy in transition. Against this background, efforts dedicated towards implementing the provisions of the Energy Charter Treaty (ECT) and of the Protocol on Energy Efficiency and Related Environmental Aspects (PEEREA) have to be noted. The country ratified the ECT and PEEREA in September 1998.

The country is not rich in natural resources, with the exception of lignite and hydro. Fuel diversification and reducing dependence on imported resources are strong reasons for promoting energy savings. Increasing the penetration of natural gas and improving the interconnection with neighbouring countries are high priorities.

The average total primary consumption of energy in the Republic of Macedonia is around 2.6 Mtoe annually. Within the primary energy supply, the share of crude oil is 30%, of coal 51%, of natural gas 3%, and the remaining around 15% are hydro energy, fire-wood and geothermal energy. The total consumption of energy is provided by around 60% of domestic production and 40% from import.

The basic energy infrastructure in the Republic of Macedonia includes the following: electricity power system with 1 524 MW installed capacity, lignite coal mines, gas pipeline system with annual capacity of 800 million m³, an oil refinery, an oil pipeline, five district heating systems with total capacity of 600 MW and small geothermal systems.

The Ministry of Economy is the responsible government body for the energy issues. The regulation of the energy market is performed by the independent regulatory body, the Energy Regulatory Commission of the Republic of Macedonia.

In 1999 the Government adopted a Programme on Efficient Energy Use in the Republic of Macedonia until 2020. The preparation of this programme was also a legal obligation stemming from the Energy Law adopted in 1997. This Programme includes measures for increasing the energy efficiency, among which: preparation of a national strategy on energy efficiency until 2020; legal and other incentive measures; establishment of a fund for financial support; investment projects development and implementation; preparation of regulations, standards and other acts; informational and educational activities; publications and brochures; international activities.

The Energy Efficiency Strategy of the Republic of Macedonia until 2020 was prepared in the beginning of 2004, upon an initiative of the Ministry of Economy. It was developed with financial support by USAID by the American company Nexant Inc. in cooperation with national experts, and was adopted by the Government in October 2004. The strategy includes a number of capacity building initiatives and technical activities. Institutional building and capacity building include: founding of an Energy Agency; establishing of certification of energy auditors; energy codes for facilities; equipment standards; founding an Energy Efficiency Fund.

A number of technical programmes which were identified and analysed were included into the implementation plan. Some of the more important initiatives included in the Strategy are: a Programme in housing facilities; a Programme in commercial facilities; a

Programme in buildings of public institutions; a Programme in industrial facilities; a Programme in street lighting.

A number of energy efficiency and renewable energy projects were realised or are in progress in bilateral cooperation with several European countries and international financial institutions.

1. INTRODUCTION

The Republic of Macedonia is situated in the central part of the Balkan Peninsula covering an area of 25 713 km². Its relief is characterized by large and high mountain massifs giving way to extensive, flat valleys and plains. The climate is classified as transitional from continental to Mediterranean. Summer temperature can rise as high as 40°C, while winter temperatures can fall below minus 30°C in some mountain areas.

The country is bordered by Serbia and Monte Negro to the North, Bulgaria to the East, Greece to the South and Albania to the West. It is a major transit way for shipment of goods from Greece, through the Balkans, towards Eastern, Western and Central Europe and through Bulgaria to the East.

The population of Macedonia is slightly over 2 million people. The capital is Skopje (over 600 000 citizens). Other major cities are Bitola, Tetovo, Gostivar, Veles, Kumanovo, Ohrid and Stip.

Macedonia has significant deposits of lead and zinc ores, copper, nickel, coal, decorative and architectural building stone, and non-metallic minerals, such as bentonite, fire-resistant clays, gypsum, quartz, opalite, and feldspar.

Economical indicators

The Republic of Macedonia is a small economy with a gross domestic product of USD 5.133 billion in 2003, representing about 0.01% of the total world output. It also is an open economy, highly integrated into international trade, with a total trade-to-GDP ratio of over 90%. Agriculture and industry have been the two most important sectors of the economy, but the services sector has gained prominence in the past few years. Like most transition economies, problems persist, even as Republic of Macedonia takes steps toward reform. A largely obsolete industrial infrastructure has not seen much investment during the transition period. Work force education and skills are competitive, but without adequate job opportunities, many with the best skills seek employment abroad. A low standard of living, high unemployment rate, and relatively low economic growth rate are the major economic problems.

Political System

The unicameral assembly (Sobranie) consists of 120 seats. Members are elected by popular vote from party lists, based on the percentage the parties gain of the overall vote in each of six election districts of 20 seats each. Members of parliament have a 4-year mandate.

The prime minister is the head of the government and is selected by the party or coalition that gains a majority of seats in parliament. The prime minister and other ministers are not members of the parliament.

The president represents Republic of Macedonia at home and abroad. He is the commander in chief of the armed forces of Republic of Macedonia and heads its Security Council. The president is elected by general direct ballot and has a term of 5 years, with the right to one re-election.

Administrative-territorial structure

The territorial organisation of the Republic of Macedonia, pursuant to the Law on the Territorial Organization of the Local Self Government, adopted in 2004, is structured in 84 municipalities and the city of Skopje, the capital of the country, as a separate unit of local self government. The municipalities are responsible for the local economic development. The Law provides the opportunity for the municipalities to join their funds and to form joint public services, in order to realise their competencies.

International cooperation

The Republic of Macedonia remains committed to pursuing membership in the European and global economic structures. It became a full World Trade Organization (WTO) member in April 2003. Following a 1997 cooperation agreement with the European Union (EU), Republic of Macedonia signed a Stabilization and Association Agreement with the EU in April 2001, giving Republic of Macedonia duty-free access to European markets. The Republic of Macedonia has signed Free Trade Agreements with Albania, Bosnia and Herzegovina, Serbia and Montenegro, Bulgaria, Croatia, Ukraine, Slovenia, Turkey, Romania, and the European Free Trade Association countries. It also has signed an Interim Free Trade Agreement with the UN Mission in Kosovo.

The priority policy objective and strategic interest of the Republic of Macedonia is full membership in the European Union. As a relatively small developing country which is landlocked, the Republic of Macedonia strives to achieve openness, cooperation and connection with neighbouring countries, as well as with the countries from the wider region. From both political and economic aspects, it is crucially important for the Republic of Macedonia to strengthen the connection and partnership on the ground of common interests. Furthermore, the stability and prosperity of the Republic of Macedonia as a crossroad in South Eastern Europe is of major significance for the European Union.

On 17.12.2005, the European Council granted the Republic of Macedonia a candidate status for membership in the European Union.

2. BACKGROUND: ENERGY POLICIES AND PRICES

2.1. Energy Policy - General Trends and Objectives

Energy system

The average total primary consumption of energy in the Republic of Macedonia is around 2.6 Mtoe annually. Within the primary energy supply, the share of coal is 51%, of crude oil 30%, of natural gas 3%, and the remaining around 15% are hydro energy, fire-wood and geothermal energy. The total consumption of energy is provided by around 60% of domestic production and 40% from import.

The basic energy infrastructure in the Republic of Macedonia includes an electricity power system, lignite coal mines, gas pipeline system, an oil refinery, an oil pipeline, five district heating systems and small geothermal systems.

The total installed capacity for **electricity production** is 1524 MW, with annual production of around 6.5 GWh, 1010 MW of which are from thermal power plants with annual production of 5 GWh (excluding TEP "Negotino"), and 514 MW are from hydro power plants with annual production of around 1.5 GWh.

The **gas** pipeline system of the Republic of Macedonia has a capacity of 800 million m³ per year. The main transmission gas pipeline is around 98 km long, stretching from the border with Bulgaria to Skopje. So far, the main gas pipeline branches to the cities with length of 26 km and the distribution gas network with length of 31.5 km have been built.

The Republic of Macedonia has no **oil** deposits. All crude oil originates from import and is transported from Thessaloniki (Greece) to the refinery in Skopje through an oil pipeline with capacity of 2.5 million tonnes per year. The average annual consumption of oil derivatives is approximately 0.8 million tonnes.

The **coal** used in the Republic of Macedonia is lignite (heating value of 6500-8000 kJ/kg, with 0.5-1.5% contents of sulphur and 8-25% of ashes). The annual production of lignite is about 7.2 million tons. The largest coal mines are part of thermo electricity plants and that coal is used for electricity production (around 7 million tonnes per year). Around 200 000 tonnes of coal per year from the smaller mines are used for satisfying the needs of industrial consumers and households.

Currently, five **district heating systems** are operational in the country with total capacity of 600 MW, powered by heavy oil, natural gas and lignite. About 50 000 households are connected to district heating systems.

The **geothermal energy** has a small share of about 0.3% in the total primary energy supply.

Planned developments of the energy system

According to the energy balance of the country for 2006, the total needs are planned to grow with about 9% mainly as a result of the restarting of certain economic capacities in industry and the intensive energy use in the households. Worth noting is the increase of electricity import from 1.662 mil. kWh or 20.45% from the total needs in 2005 to 2.994 mil kWh or 33.53% in 2006.

Respecting the existing structure of the energy balance, the available energy resources and financial possibilities, the further development of the energy system in the country will be based on more intensive use of the domestically available energy resources, increasing the use of natural gas, adequate change in the structure of the consumption of liquid fuel and more intensive connection to the energy systems of the neighboring countries. Here, the main characteristics are that the construction of the facilities would be done by concessions using the BOT model and including independent energy producers from domestic and foreign legal and natural entities, without the participation of the state.

In the power system the construction of big and small hydro power plants and combined heat and power (CHP) plants and thermo power plants with natural gas will be intensified. In 2006, the construction of the first packages of 21 small HPP (total power of 17.704 MW, annual production of 72.921 GWh) will start. The works for the construction of other bigger and small HPP will continue. With those, the utilization degree of the hydro potential in the country will be increased from 28% in 2005 to about 50% in 2015. This will also increase the share of electricity in the national energy balance from about 15% in 2005 to about 25% in 2015, and that would improve the elasticity and the security of the power system in the country and respectively the quality of electricity distribution to the consumers.

Also in 2006, the construction of the first CHP plant with natural gas from Russia will start, i.e. TE-TO "Skopje" (installed capacity of 190 MW electricity and 150 GW heat). The works for construction of other thermo power plants on natural gas will continue in other locations in the country where there are no existing district heating systems. Thus the natural gas would be intensively included in the electricity generation, which would contribute to greater elasticity and security of the power system of the country.

With the construction of the above mentioned electricity sources the offer for the consumers in the country and on the regional electricity market would be increased.

In the gas sector, extension of the gas line network in the direction Skopje-Tetovo-Gostivar-Kicevo (with side track to Debar)-Struga-Ohrid, 230 km long, the shortest section through which the Republic of Macedonia can connect to the Republic of Albania for the purpose of supply with Russian natural gas, and also it is planned that the network will be extended to all of the major cities in the country. Thus, beside the first group of consumers (the industrial sector), the gas TPP and the households will be also connected to it. There is already some documentation at disposal (ideas and pre-feasibility studies) for gasification of six districts in Skopje and gasification of certain areas in the cities of Kriva Palanka, Kratovo and Kumanovo, through which the main gas pipeline system passes from the Macedonian-Bulgarian border to Skopje. With these constructions the consumption of natural gas will be enormously increased in the Republic (in 2005 77.32 mil. m³), that will result in reduced use of electricity and certain oil derivatives for thermal needs. That, of course, will have a positive influence on the environment in many regions of the country.

In the oil sector, more significant development project is the construction of the pipeline for oil derivatives Skopje (R.M) - Pristina (UNMIK, Kosovo) with total length of 115 km and annual capacity of 300 000 t. That will increase the processing of crude oil in the Refinery of crude oil OKTA, Skopje from 1.05 million tons in 2005 to more than 1.5 million tons during the next years.

In this sector it is also important that the market introduction of oil derivatives with better quality has started gradually. Before 2005, the motor benzene used in the country was BMB 95 and BMB 90 with content of lead of 0.013 gr/l and MB 96 with content of 0.15 gr/L lead. Also during that period diesel fuels were used with 2 000 mg/kg, that is, 0.20% sulphur, and mazut with M1 with 2% sulphur and M2 with 3% sulphur.

The new European standards EN 228 2005 for benzenes and EN 590 2005 for diesel fuels are planned to be introduced in 2006. A study is planned for the second half of 2006, which will analyse the production possibilities of the Refinery OKTA in Skopje, the stocks of the existing fuels and the dynamics of their application in the region. The

results from the study will be used for the amendment of the Rulebook for the quality of the liquid fuels, unleaded fuel and diesel fuel with specifications and dynamics of implementations.

In the coal sector the ambition is to develop mines for lignite for further supply of the existing thermal power plants in the Republic (“Bitola” and “Oslomej”). Extraction of coal in the mine “Brod Gneotino” is in process for extension of the working life of TPP “Bitola”. The opening of other smaller coal mines is also planned for the next years in order to supply the need of the households and part of the industry.

Energy sector reform

The Republic of Macedonia has progressed well with the energy sector reform. The 1997 Energy Law and its amendments provided a basis for the restructuring of the energy sector and liberalisation of the energy market. An independent energy regulator was established in 2002. The restructuring of the electricity sector started in 2004 with the separation of power generation, distribution and supply from power transmission and grid management within the state owned power company ECM (Electrostopanstvo na Macedonia). Consequently, in 2005 ESM was split, initially into a transmission company (MEPSO) and generation and distribution company (ESM). Further on separate companies for generation and distribution were established and put into privatisation procedures. In the beginning of 2006 electricity distribution company AD ESM was successfully privatized by 90 % of its shares. In the oil sector privatization is completed and competitive markets exist. The gas sector was also restructured and its privatization has advanced.

The energy policy in the country generally contains the following strategic directions: approximation to the legislation to the EU, establishing market conditions in the energy field, strengthening the role of the Regulatory Commission, reforms in the transformation of the energy sector, further development of the energy systems by construction of new energy generating facilities and multiple connections to the energy systems of the neighbouring countries, increasing energy efficiency, more intensive use of renewable energy resources in the country and introduction of adequate environmental standards and measures. These strategic priorities are further developed and strengthened with the new Energy Law, which was adopted by the Macedonian Parliament on 11 May 2006.

The Republic of Macedonia has ratified the EC Treaty for South East Europe on 3 May 2006. The main goal of this Treaty is to provide free energy trade under transparent conditions between the countries from the region and with the EU member state. The Treaty contains the obligations for the SEE states to implement the Acquis Comminautaire in the field of energy, competition, environment and renewable energy sources. Beside the reforms in the institutions and regulation of the markets with electricity and natural gas, the Treaty creates obligations for the Republic of Macedonia in a period of one year to implement the provisions of Directives 2003/54/EC and 2003/55/EC, and to create a framework for opening the market for all customers except households to be able to choose their supplier by 2008, and for all customers by 2015. Within a year after the Treaty comes into force, it is necessary to prepare a plan for implementation of the *acquis comminautaire* in the field of renewable energy sources

and for removal of subsidies and practices which obstruct the competition on the energy market. As for the implementation of the *acquis communautaire* in the environmental field, an implementation plan already exists.

Summary Table I: Priority of Policy Objectives

Please prioritise from 1 (the highest) to 5 the objectives of your energy policy.

Policy objective	Mark
Reduce total final consumption / GDP	2
Reduce dependency on energy imports	1
Diversification of fuels	4
Reduction of CO ₂	5
Increase utilisation of indigenous primary energy sources	3

2.2. Energy Policy Implementation

The Ministry responsible for the energy policy development and implementation is the **Ministry of Economy**. The Ministry of Finance, the Ministry of Environmental Protection and Physical Planning, the Ministry of Agriculture, Forestry and Water Economy, and the Ministry of Transport and Connections are also involved.

The **Energy Regulatory Commission** of the Republic of Macedonia became operational in 2003. It is engaged in establishing tariff systems and prices, licensing, and customer protection.

In July 2005 the Law for Founding an **Energy Agency** of the Republic of Macedonia was adopted. The founding of the Energy Agency is already in process. The Agency will be independent in its work, and financially accountable to the Ministry of Economy. The defined role of the Agency is to initiate, coordinate, study and prepare appropriate documents, together with domestic and foreign specialized companies and experts, and to suggest concrete solutions and activities to the Government, through the Ministry of Economy. Specific activities of the Agency will be aimed towards: preparation of mid-term and long-term strategies and development plans; preparation and coordination of the energy reforms; proposal and evaluation of studies and projects on the energy sectors, energy efficiency and renewable energy sources; preparation and coordination of the implementation of investment projects; regional cooperation and coordination of regional projects, and other activities.

Other institutions involved in policy implementation are the local authorities, and the Macedonian Energy Association (MEA) under the Macedonia Chamber of Commerce. MEA was founded in May 2005 and its members are 33 companies – producers, maintainers of energy systems, and the biggest energy consumers.

2.3. Energy Prices

2.3.1. Energy pricing policy

The regulation of the energy market is performed by the independent regulatory body, the Energy Regulatory Commission of the Republic of Macedonia.

According to the Amendment of the Energy Law from 2005, the regulated generator of electricity and the wholesale supplier of electricity conclude agreements for selling/buyout the entire available electric power for tariff customers under regulated prices and tariffs approved and published by the Energy Regulatory Commission.

The wholesale supplier of electricity for tariff customers concludes regulated agreements for sale of power and electricity with the retail supplier of electricity for tariff customers and with the direct tariff customers (connected to the transmission grid).

The retail supplier of electricity for tariff customers purchases power and electricity from the wholesale supplier of electricity for tariff customers and from the distributed electricity generators, as well as the required transmission and distribution capacity and regulated services for the needs of the tariff customers connected to the distribution system, under the prices approved and published by the Energy Regulatory Commission.

The eligible customers may conclude contracts for the power and the electricity, with the electricity generators (not regulated) and the electricity traders and are liable to register these contracts at the electricity market operator.

The customer that wish to change its status (from an eligible customer into a tariff customer, or vice versa) submits a request to the Energy Regulatory Commission together with the appropriate documentation, which confirms the planned level of consumption. The Energy Regulatory Commission updates and publishes the list of the eligible customers in the "Official Gazette of the Republic of Macedonia".

The oil market is completely competitive and there is a separate price for each oil derivate set by the Energy Regulatory Commission.

For distribution of natural gas, operation of the gas distribution system, supply of natural gas for tariff customers, distribution of thermal or geothermal energy, a license can be issued only to one person who performs some of these energy activities on a particular administrative area.

The Energy Regulatory Commission is responsible for the price regulation and adopts methodologies for setting the prices of electricity, gas, geothermal energy, central heating and oil. The methodologies for setting the prices for electricity, gas, central heating and geothermal energy are based on incentive based methods and the oil prices are set on the basis of cost plus method. No subsidies are considered in all tariff methodologies.

The Regulatory Commission has adopted several internal acts for its normal functioning and operation, but also the following important legal acts and regulations:

- Rulebook on the method and conditions for regulating electricity prices, 2004;
- Rulebook on the method and conditions for regulating prices for transport, distribution and supply with natural gas, 2005;
- Tariff system for transport of natural gas, 2005;
- Tariff system for selling natural gas to tariff customers, 2005.

There are no subsidies in the tariffs and there are partly cross-subsidies in electricity tariffs. There are no social or other subsidies directed to the consumers.

There are no taxes applied on energy consumption and emissions.

According to the financial review for 2005 from ESM Distribution, which is the only electricity distribution company of the Republic of Macedonia, the collection rate from the electricity consumers was 82.95 % in 2005.

2.3.2. Price levels

Prices of electricity for industrial consumers which are connected on 110, 35, 10 and 0.4 kV (I and II tariff degree) voltage level are average prices in accordance with the tariff system. Prices of electricity for households are also average prices in accordance with the tariff system. The prices of generation (0.026 US\$/kWh), use of transmission network (0.002078 US\$/kWh), and distribution of electricity (0.018104 US\$/kWh), for the first time are determined separately for 2005, in accordance with the new tariff methodology which was adopted by ERC at the end of 2004.

Prices of separate oil derivatives are formed and approved as highest prices according to the methodology issued in the Agreement for stock sales and concession of the Refinery Joint stock company "OKTA"-Skopje, signed among the Government of the Republic of Macedonia and the joint stock company "EL.P.E.T.-Balkanike" as strategic investor.

Summary Table II: Energy Prices

Energy Prices	Yes	No	Partly
Is there an independent regulator of energy prices?	X		
Are there any subsidies on energy prices?		X	
Are there any cross-subsidies?			X
Are the environmental costs fully internalised?		X	
Do you have a tax related to energy consumption?		X	
Do you have a tax related to CO ₂ emissions?		X	

3. END-USE SECTORS

3.1. Residential Sector

The major consuming sector is the residential sector which accounts for 25% of the Total Final Energy Consumption. Electricity is the major energy used in the sector, accounting for some 54% of the end use electricity consumption. Of these, 71% goes for space conditioning (predominantly heating), 17% for water heating, and 12% for appliances. The total annual electrical use for ambient conditioning in this sector is 1 883 536 MWh. This high level of electricity use makes this area the prime target for improvement programs.

There are approximately 600 000 residences in Macedonia, many heated with electricity. Since electricity is expensive, and the electrical supply capacity is insufficient for all uses, reducing electrical usage through conservation or fuel switching is very desirable. Areas having district heating should look to expand their service territory, where justified by household density, especially if the existing buildings are heated with electricity. However, expansion of the district heating systems is not likely in the short term. As natural gas becomes available, buildings could be converted to natural gas fired boilers. In addition, energy efficiency improvements will lower the heating demand. These techniques will reduce the electricity demand, and the heating bills of the residents.

Metering consumption is a basic principal of economics. Converting the existing calculation basis of district heating to a consumption based cost would encourage conservation, and would eliminate any inequalities that exist in the current system, under which the residents are billed on floor area only. Since meters are already installed, this change could be accomplished without substantial costs.

3.2. Industrial Sector

Industry contributed for 26.3 % of GDP in 2004. At present, the industry sector accounts for nearly 25% of the Total Final Energy Consumption and for 27% of the total electricity consumption in the country. However, this consumption is expected to grow, as Macedonia modernizes its plants, increases production, and resumes exporting internationally.

This situation offers a unique opportunity for approaching the industrial upgrading process with energy efficiency technologies and management methods.

The main industrial consumers of energy, both electric and thermal, in Macedonia are: metallurgy, manufacture of rubber and plastic products, textile industry, food industry, chemical industry, tobacco industry, manufacture of metal products, paper mills, wood processing.

The energy intensity index of the Macedonian industrial sector, i.e., the amount of energy consumed in average per unit of production, is approximately five times higher

than the indexes of France and United Kingdom. This indicates that large savings, mainly of electricity, but also of thermal energy, can be achieved with a combination of no-cost, low-cost, and high-cost interventions.

On the basis of past experience, we can anticipate the most frequent and important energy efficiency measures with reasonable accuracy. These are:

- Power factor improvement
- Lighting systems
- Electric motors and drives replacement with high efficiency ones including variable speed drives (only when replacement is necessary)
- Avoidance of electric power conversion to process heat
- Modification of production flow and organization to a) spread load uniformly over the entire production daily schedule, and b) avoid keeping equipment in “hot stand-by” when not strictly required
- Boiler efficiency improvement
- Air compressors
- Waste heat recovery
- Thermal insulation upgrade
- Cogeneration

3.3. Services Sector

The commercial buildings sector has been steadily increasing its energy consumption. In 2003, consumption in this sector had reached some 15% of the Total Final Energy Consumption. Recent experience in EU countries has shown that energy consumption in office building can be reduced substantially while maintaining a similar level of quality for the user. EU countries have adopted a wide range of measures to promote energy conservation, including:

- Energy certification of buildings;
- Efficient operation of building energy systems;
- Energy labeling of appliances; and
- Insulation standards

Many of these same concepts can be utilized in Macedonia, due to the similarity in building construction and materials used.

Institutional Buildings represent approximately 4.4% of the national electric energy consumption, or approximately one tenth of the consumption in the residential buildings.

The amount of electric energy used in Macedonia for street lighting, although modest, has been steadily increasing and in 2001 reached approximately 74 MWh, representing 1.42% of the total national consumption. Over 86% of the total street lighting systems are equipped with inefficient lamps.

4. ENERGY EFFICIENCY POLICIES

4.1. Energy Efficiency Policy

Energy efficiency enhancement and greater participation of renewable energy sources in energy supply are among the major strategic objectives of the Government of the Republic of Macedonia in the energy sector. They are very important for the security and economical supply of the energy consumers, and for sustainable energy development in the state, in the region and widely.

In 1999 the Government adopted a Programme on efficient energy use in the Republic of Macedonia until 2020. The preparation of this programme was also a legal obligation resulting from the 1997 Energy Law. The Programme determines many measures on increasing the energy efficiency, among which: development of an Energy Efficiency Strategy of the Republic of Macedonia until 2020; legal and other incentive measures; establishment of a fund for financial support; investment projects development and implementation; preparation of regulations, standards and other acts; informational and educational activities; publications and brochures; international activities.

The Energy Efficiency Strategy was prepared in the beginning of 2004, upon an initiative of the Ministry of Economy and with USAID financial support by the American company Nexant Inc., in cooperation with national experts. The Strategy was adopted by the Government in October 2004.

The Strategy includes a number of capacity building initiatives and technical activities. Institutional building and capacity building include the following activities: founding an Energy Agency; establishing a certification for energy auditor; energy codes for facilities; equipment standards; founding an Energy Efficiency Fund. A number of technical programmes which were identified and analysed were included into the implementation plan. Some of the more important initiatives included in the Strategy are: A Programme in housing facilities; a Programme in commercial facilities; a Programme in buildings of public institutions; a Programme in industrial facilities; a Programme on street lighting.

4.2. Legal Framework

Republic of Macedonia has no specific Energy Efficiency Law, but energy efficiency is included with a special chapter in the new **Energy Law** adopted in May 2006. In the chapter “Energy Efficiency” the national policy and activities for improvement of energy efficiency are elaborated.

The Energy Law contains provisions about the development of a Strategy for improvement of energy efficiency for a period of ten years and a Programme for the implementation of the Strategy. The activities in the energy efficiency field are defined in secondary legislation:

- The *Rulebook for energy efficiency of new buildings and reconstruction of existing ones* closely defines the criteria that have to be met by buildings from the aspect of energy efficiency. By this rulebook the EU Directive on energy performance of buildings will be transposed.
- *The Technical specifications and standards for efficient exploitation of fossil fuels* closely define the energy efficiency criteria which have to be met by the motor vehicles, thermoelectric plants, thermal plants and other energy intensive industrial capacities and the ways of controlling the implementation of the specifications. The technical specifications for efficient exploitation of fossil fuels in motor vehicles shall be closely defined by the minister in charge of transport issues. The technical specifications for efficient exploitation of fossil fuels in thermoelectric plants, thermal plants and other energy intensive industrial capacities shall be closely defined by the minister in charge of energy issues.
- The *Rulebook for energy efficiency labeling of household appliances* closely defines the energy efficiency criteria which have to be met by the household appliances. It will transpose the relative EU legislation in this area.

4.3. Energy Efficiency Targets

The energy programs suggested by the Energy Efficiency Strategy are estimated under high, medium, and low penetration scenarios. The actual penetration levels will reflect factors including energy pricing and billing practices (e.g., higher energy prices and increased use of consumption-based billing should produce higher penetration rates); marketing of the programs; and other energy policy and program administration considerations including public education and training of specialists. The following table indicates the estimated percentages of energy that can be saved per average participant and the total percentage saving for each sector under each penetration level.

Sector	Average Per-Participant Savings (%)	High Penetration Scenario	Medium Penetration Scenario	Low Penetration Scenario
Residential				
Penetration Rate %	---	25	20	15
Achievable Svgs %	15	3.75	3.0	2.25
Commercial				
Penetration Rate %	---	40	30	20
Achievable Svgs %	10	4.0	3.0	2.0
Institutional				
Penetration Rate %	---	50	40	30

Sector	Average Per-Participant Savings (%)	High Penetration Scenario	Medium Penetration Scenario	Low Penetration Scenario
Achievable Savings (%)	20	10.0	8.0	6.0
Street Lighting				
Penetration Rate %	---	40	30	20
Achievable Savings (%)	25	10.0	7.5	5.0
Industrial				
Penetration Rate (%)	---	40	30	20

The following table shows the savings per sector relative to Macedonia's total electricity - use under the three penetration scenarios.

Program	Sector Consumption MWh	Sector Consumption %	Average Per-Participant Savings (%) ²		Low Scenario %	Medium %	High Scenario %
Overall	6 439 000	100		% TOTAL	2.0	2.805	3.61
Residential	2 652 868	41.2	15%	% total	0.93	1.24	1.55
				Penetration Rate	15%	20%	25%
Commercial	643 900	10	10%	% total	0.20	0.3	0.4
				Penetration Rate	20%	30%	40%
Institutional	283 316	4.4	20%	% total	0.26	0.35	0.44
				Penetration Rate	30%	40%	50%
Industry/ Agriculture	1 738 530	27	10%	% total	0.54	0.81	1.08
				Penetration Rate	20%	30%	40%
Street Lighting	90 146	1.4	25%	% total	0.07	0.105	0.14
				Penetration Rate	20%	30%	40%

² The estimated electrical savings percentage column represents the savings potential for each sector. These values must be multiplied by the respective penetration rate to obtain the overall impact for each sector. For instance, the residential sector with a medium penetration rate of 20% would be expected to have an overall savings of 3% of the electrical energy consumed in the sector (15% times 20%) which when related to the overall electrical demand represents 1.24% of the overall electrical energy demand.

4.4. Energy Efficiency Priorities

The objectives of all activities in the field of energy efficiency and renewable energy sources are energy efficiency improvement, less energy intensity in domestic, public, commercial and industry sectors, greater involvement of renewable energy sources in energy consumption, depend less on energy import, safety and economical supplying the energy consumers, and better conditions for sustainable energy development with all aspects of environmental protection.

4.5. Energy Efficiency Financing

Since 2000 there have been no Budget financial sources allocated for energy efficiency activities, and all energy efficiency projects during this period were realised through international cooperation.

In the period from July 2004 to May 2006, the Project for Preparation of a Sustainable Energy Programme is going on. Under this programme a grant of 5.8 million USD from the Global Environment Facility (GEF) will be received, through the World Bank as an implementation agency. The basic objective of this Programme is to stimulate investments in energy efficiency and use of renewable energy sources by removal of institutional and financial barriers.

The GEF grant will be used to fund (i) market transformation activities using technical assistance funds (ii) development of a utility-based Energy Service Company to implement third-party financing of energy efficiency projects; and (iii) investment in energy efficiency and renewable energy through a Sustainable Energy Financing Facility.

The project has three components:

- Market Framework, including: 1) technical assistance focused on supporting the Government in designing and implementing policy and secondary legislation on the inclusion of renewables in the electricity sector; and 2) project development and project investment support.
- Support to Utility-based ESCO under the umbrella of the Macedonian Market and Transmission System Operator (MEPSO). The ESCO will help to stimulate the market for energy services by providing turnkey and performance-based contracting for energy efficiency, and by demonstrating the financial performance of such projects using third-party financing for publicly-owned buildings.
- Sustainable Energy Financing Facility, consisting of a loan guarantee facility and a debt fund, on a co-financing basis with commercial institutions and the Macedonian Bank for Development Promotion (MBDP). The guarantee facility will focus exclusively on energy efficiency projects, while loans from the debt fund would be applied to both energy efficiency and renewable energy projects.

4.6. International Co-operation

In the previous period, in bilateral cooperation with several European countries and international financial institutions, a number of energy efficiency and renewable energy projects were realised, there are some ongoing projects as well.

In the period between 1998 and 2003, through the PSO Programme of the Government of the Netherlands, five projects on energy efficiency and exploitation of renewable energy sources were implemented.

In bilateral cooperation between Republic of Macedonia and Austria, in November 2005 an Agreement for financial support between the Macedonian Ministry of Economy and the Austrian Development Agency was signed for realization of the Solar Water Heaters project (2005-2008). The project includes training of experts and producers for solar energy, realization of a program for improving the technology of production of solar installations and systems, establishment of national labelling for solar installations and related legislation.

With financial and technical support by the Swiss State Secretariat for Economic Affairs (SECO), the Efficient Energy Distribution Project is currently under implementation in the Republic of Macedonia. The project includes the following components: Replacement and addition of Condenser Batteries in the Distribution System (Component I) and Numeric Measuring System for Active, Reactive Energy and Power (Component II). The project focuses mainly on the pollution problem and aims at decreasing the energy losses in both commercial and technical aspect. Both are necessary improvements of the energy infrastructure of Macedonia. In addition, a substantial assistance programme on technical, institutional and policy level in the area of energy efficiency (Component III) and of POPs abatement (Component IV) are under implementation. The main objectives of Component III are data gathering survey from 1250 households, analysis and evaluation of data collected by household survey, identification of pilot projects, and workshop for improvement of energy efficiency in households.

Memorandum of Understanding was signed in October 2004 with ISOFOTON, a Spanish company for production of solar thermal collectors and installations and photovoltaic cells. Under this MoU, a Feasibility Study for Solar Energy Application in the Production of Thermal and Electrical Energy in Republic of Macedonia should be completed. If the study identifies feasible potential, the Spanish Government will provide a soft credit line to support investments for installation of solar equipment.

The Project for Preparation of a Sustainable Energy Program with GEF grant, mentioned earlier, should also be considered as an important international cooperation activity of Macedonia for energy efficiency improvement and utilisation of renewables.

4.7. Energy Efficiency Institutions

Government Institutions

The Ministry of Economy is responsible for the design and formulation of the overall energy policy, including energy efficiency. Responsibility within the Ministry is with the Energy Department.

Other Ministries involved in energy efficiency issues are the Ministry of the Environment and Physical Planning, the Ministry of Agriculture, Forestry and Water Economy, the Ministry of Transport and Communications.

The Energy Agency of the Republic of Macedonia, which is in process of establishing, will have an important role for increasing the activities in the area of energy efficiency and renewables. In compliance with the Law, the Energy Agency will have the following jurisdiction relating to energy efficiency and renewable energy sources: develop initiatives, propose and coordinate studies and projects for energy efficiency and RES; cooperate with the Ministry of Economy for implementation of the Action Plan for realization of the Energy Efficiency Strategy; issue guarantee for origin for electricity produced from RES; propose and incorporate measures for environment protection in the energy projects, etc. Under the GEF project, which is under preparation, a Project Development Assistant Facility will be settled as a separate Sustainable Energy Unit within the Energy Agency.

The Research Centre for Energy, Informatics and Materials of the Macedonian Academy of Sciences and Arts (ICEIM-MANU) was established in 1994 with a mission of initiating and coordinating national research programs and performing high-level research in selected fields, both applied and basic. Since then, the whole scientific activity has been realized through over forty research projects, out of which twenty nine international - funded from EC, UN Agencies, USAID and some European governments. Specifically, the applied research of the Centre has been devoted to energy strategies, energy efficiency and renewable energy sources, as well as the environmental impacts of various energy technologies, including greenhouse gases emissions and climate change. The results contributed to some strategic documents, adopted by the government, which shape the national policy in energy and the environment sectors.

The Macedonian Centre for Energy Efficiency (MACEF) has a mission to increase the energy efficiency and environmental protection at national level by implementing measures and capacity building in cooperation with governmental institutions, local self-government, engineers, donor organization and ecologists. MACEF's mandate incorporates: promotion and implementation of EE measures to protect environment; advises and expert counselling for energy and drinking water efficiency management; planning for energy and energy recourses development; planning and implementation of Action Plans for EE at municipality level; regional and international collaboration; and, participation in National Energy Policy Designs.

Summary Table III: Energy Efficiency Policies

Energy efficiency policies	Yes	No	Partly
Has an energy efficiency policy been developed?	X		-
Is energy security a driving force for energy efficiency?			X
Is climate change/environment a driving force for energy efficiency?	X		
Is sustainable development a driving force for energy efficiency?	X		
Is employment creation a driving force for energy efficiency?			X
Is industrial competitiveness a driving force for energy efficiency?			X
Is export of technology a driving force for energy efficiency?			X
Is comfort perceived as a priority for improving energy efficiency?			X
Are international obligations a driving force for energy efficiency?	X		
Is there an energy efficiency law?		X	-
Is energy efficiency incorporated in other legislation?	X		
Have national targets been formulated?	X		
Is there a special fund for energy efficiency?		X	-
Is there international cooperation in the field of energy efficiency policies?	X		

5. ENERGY EFFICIENCY INSTRUMENTS AND MEASURES

5.1. Cross-sectoral Instruments and Measures

Table 5.1. Cross-sectoral instruments and measures

TYPE OF INSTRUMENTS	PROGRAMME DESCRIPTION AND AIMS	IMPLEMENTATION STATUS	BUDGET	(EXPECTED) RESULTS
Energy Efficiency Strategy of the Republic of Macedonia till 2020	To develop a framework for accelerating the adoption of energy efficiency practices in a sustainable way through implementation of a series of programs and initiatives focused on end-use efficiency that are linked to creating a critical mass of concerned and committed professionals by complementary advocacy and training activities that maximize the involvement of and opportunities for the private sector.	Establishing institutional capacities for technical and financial support for realization of EE projects		Realization of the technical programmes which are included in the implementation plan of the Strategy
Macedonia Sustainable Energy Program	The objective of the program is to develop a sustainable market for EE and RE by supporting the development of an enabling framework, institutional capacity, and necessary financing mechanisms	Finalization of preparation phase of the programme	US\$ 5.8 million from GEF	Realization of number of EE and RE projects during the next five years of the implementation period; decreasing energy intensity, greater involvement of renewable energy sources in energy consumption, and reduction of CO ₂ emissions.
Establishing an Energy Agency of the Republic of Macedonia	The Energy Agency will have the following jurisdiction relating to EE and RES: develop initiatives, propose and coordinate studies and projects for EE and RES; cooperate with the Ministry of Economy for implementation of the Action Plan for realization of the Energy Efficiency Strategy; issue guarantee for origin for electricity produced from RES; propose and incorporate measures for environment protection in the energy projects, etc.	Phase of establishment	US\$ 1.0 million from GEF and US\$250000 from the State Budget	Reinforced institutional capacity in the field of EE and RE; increased activities in the area of EE and higher share of RE

5.2. Instruments and Measures in the Residential Sector

Table 5.2. Instruments and measures in the residential sector

TYPE OF INSTRUMENTS	PROGRAMME DESCRIPTION AND AIMS	IMPLEMENTATION STATUS	BUDGET	(EXPECTED) RESULTS
Adoption of secondary legislation for EE in buildings	Rulebook for construction of new buildings and reconstruction of existing ones from the aspect of energy efficiency, where the EU Directive on energy performance of buildings will be transposed	Following the adoption of the new Energy Law		Improvement of EE in buildings, reduction of CO ₂ emissions
Adoption of secondary legislation for EE labelling of household appliances	Rulebook for energy efficiency labelling of household appliances, where EU directives in this area will be transposed	Following the adoption of the new Energy Law		Improvement of EE in the residential sector, reduction of CO ₂ emissions
EE project in the residential sector	Survey of 1250 households, analysis and evaluation of the data collected, identification of pilot EE projects, and workshop for EE improvement in households.	Completed in the end of 2005	CHF 134700 by the Swiss Government	
Promotion of solar thermal systems in the residential sector	In the framework of the "Solar Water Heaters" project there is a component for organizing a campaign for solar thermal use in households	Ongoing project	Within the budget of "Solar Water Heaters" project	Improvement of EE and greater usage of RE in the residential sector, reduction of CO ₂ emissions

5.3. Instruments and Measures in the Industrial Sector

Table 5.3. Instruments and measures in the industrial sector

TYPE OF INSTRUMENTS	PROGRAMME DESCRIPTION AND AIMS	IMPLEMENTATION STATUS	BUDGET	(EXPECTED) RESULTS
Sustainable Energy Financing Facility SEFF	A guarantee facility for EE loans, and a credit facility for EE and RE within the Macedonia Sustainable Energy Program	Finalization of preparation phase	US\$ 4.0 million from GEF	Realization of number of EE and RE projects during the next five years of the implementation period; decreasing energy intensity, greater involvement of renewable energy sources in energy consumption, and reduction of CO ₂ emissions.
Project Development Assistant Facility (PDAF)	PDAF will be settled like a separate Sustainable Energy Unit within the Energy Agency	Finalization of preparation phase	US\$ 1 million from GEF and US\$250000	Realization of number of EE and RE projects during the next five years of the implementation period;

TYPE OF INSTRUMENTS	PROGRAMME DESCRIPTION AND AIMS	IMPLEMENTATION STATUS	BUDGET	(EXPECTED) RESULTS
			from the State Budget	decreasing energy intensity, greater involvement of renewable energy sources in energy consumption, and reduction of CO ₂ emissions.
Solar Water Heaters Project	Capacity Building at different levels for national experts and administration staff as well as providing national policy; practical measurements, monitoring and analyses of existing solar-installations; know-how for solar producers; development of national labelling for solar installations.	Ongoing project	300000 Euros Austrian grant	Improvement of EE and greater usage of RE, reduction of CO ₂ emissions

5.4. Instruments and Measures in the Services Sector

Table 5.4. Instruments and measures in the services sector

TYPE OF INSTRUMENTS	PROGRAMME DESCRIPTION AND AIMS	IMPLEMENTATION STATUS	BUDGET	(EXPECTED) RESULTS
Establishment of an ESCO	Development and start up of a utility-based Energy Service Company under the umbrella of the MEPSO. The ESCO will help to stimulate the market for energy services by providing turnkey and performance-based contracting for energy efficiency, and by demonstrating the financial performance of such projects using third-party financing for publicly-owned buildings	Finalization of preparation phase	US\$ 0.8 million from GEF	Improvement of EE in the public sector

5.5. Instruments and Measures in the Transport Sector

Table 5.5. Instruments and measures in the transport sector

TYPE OF INSTRUMENTS	PROGRAMME DESCRIPTION AND AIMS	IMPLEMENTATION STATUS	BUDGET*	(EXPECTED) RESULTS

Summary Table IV: Instruments and Measures

The table indicates (with X) the availability of the different policy instruments and measures groups in the national energy efficiency policy:

Sectors	Instruments					
	Normative	Financial	Information/awareness	Education/advisory	Voluntary agreements	R&D
Residential	X	X	X			X
Industry	X	X		X		X
Services		X		X		
Transport						

6. ACTORS IN ENERGY EFFICIENCY

Table 6.1. Intermediary organisations in the residential sector

RESIDENTIAL SECTOR INTERMEDIARIES	INTEREST IN KEYWORDS	ACTIVE ROLE IN EE (YES/NO)	IF YES, WITH WHICH INSTRUMENTS
Consumer Organization of Macedonia	Consumer protection	Yes	Information, consultation, professional opinion

Table 6.2. End users in the residential sector

RESIDENTIAL SECTOR, END CONSUMERS	INTEREST	ATTITUDE	ABILITY
Owners	Energy saving	Energy efficiency is important but is a problem for the owners	Low cost measures
Tenants	Energy saving	Neutral	Insignificant

Table 6.3. Intermediary organisations in the industrial sector

INDUSTRIAL SECTOR INTERMEDIARIES	INTEREST IN KEYWORDS	ACTIVE ROLE IN EE (YES/NO)	IF YES, WITH WHICH INSTRUMENTS
Macedonian Chamber of Commerce	Energy Board	Yes	Information
ZEMAK – association of Energy Engineers of the Republic of Macedonia	Professional support	Yes	Information, consultation, professional opinion
Macedonian Academy of Sciences and Arts – research centre for Energy, Materials and Informatics	Theoretical and experimental research	Yes	Scientific research, transfer of knowledge, professional opinion
MAKOCIGRE Association of Electric Engineers of the Republic of Macedonia	Professional support	Yes	Information, consultation, professional opinion
Macedonian Universities Research Centers	EE economy	Yes	Investigations, analysis, recommendations

Table 6.4. End users in the industrial sector

INDUSTRIAL SECTOR, END CONSUMERS	INTEREST	ATTITUDE	ABILITY
Manufacturing companies	Energy and financial savings	High interest in EE technologies	Improvement of technologies and introduction of new technologies

Table 6.5. Intermediary organisations in the services sector

SERVICES SECTOR INTERMEDIARIES	INTEREST IN KEYWORDS	ACTIVE ROLE IN EE (YES/NO)	IF YES, WITH WHICH INSTRUMENTS

Table 6.6. End users in the services sector

SERVICES SECTOR END CONSUMERS	INTEREST	ATTITUDE	ABILITY
Institutions of local governance	EE in public buildings		Local energy concepts

Table 6.7. Intermediary organisations in the transport sector

TRANSPORT SECTOR INTERMEDIARIES	INTEREST IN KEYWORDS	ACTIVE ROLE IN EE (YES/NO)	IF YES, WITH WHICH INSTRUMENTS

Table 6.8. End users in the transport sector

TRANSPORT SECTOR END CONSUMERS	INTEREST	ATTITUDE	ABILITY

7. RENEWABLE ENERGY

7.1. Renewable Energy Potential and Supply

Exploitation of Renewable Energy Sources (RES) is of significant importance for the Republic of Macedonia, as the country has limited domestic energy sources. In addition exploitation of RES benefits the environment and provides the opportunity for business development in all regions of the country.

Hydro

The total installed power for production of electricity from hydro power plants is 504 MW from six big hydro power plants, and 36 MW from 22 small hydro power plants. According to the Energy Balance 2006 the annual production of hydro power is around 1.5 billion kWh.

70 small hydro power plants with total installed capacity of 180 MW, and annual production of 700 GWh are planned to be constructed in the next period.

Geothermal

Macedonia is quite rich in geothermal sources exploited for different uses except for the production of electricity. The biggest part of geothermal occurrences in Macedonia is connected with the Vardar tectonic unit. Only few phenomena are placed out of this unit and its contacts.

There are 7 main geothermal fields in Macedonia with 18 localities with thermal waters, and there are more than 50 occurrences as springs and wells where thermal water appears.

The biggest amount of thermal waters can be found up to the altitude of 400 m above the sea level. Only the Kozuv Mountain springs and Baniste wells have altitude of 600m above the sea level. Temperatures of the flows vary in the range from 24-27°C to 70-78°C. Total mean temperature is 59.77°C.

About 15 geothermal projects have been developed in the Republic of Macedonia during the 70's and 80's. Some of them are still in operation but others are abandoned or work below the designed capacities. Four of them are very important and have an important influence to the development and application of geothermal energy in the country. These are the Kocani geothermal project, the Smokvica and Istibanja agricultural geothermal projects, and the integrated project in Bansko.

According to the Energy Balance 2005, the consumption of geothermal energy was 300 TJ or 0.26 % from the total energy consumption.

Wind

The wind energy potential is not adequately examined in the Republic of Macedonia. Although the issue is discussed since many years, very few references to wind energy can be found in studies and papers.

Wind data are measured in meteorological stations throughout the country. Published data are scarce and in some occasions rather vague. Special measurements for the identification of wind energy potential in specific promising sites have not been carried out. Therefore the available data can be considered indicative only.

The Vardar river basin from Kumanovo to Gevgelija is considered as the most favourable area for wind energy applications. Other areas of possible importance are the Pelagonia region, Kriva Planka, Ohrid and other mountainous areas. According to data published in the “Energy Sector Development Strategy” of the Academy of Science the area around Stip is one of the most favourable in terms of wind speed.

Biomass

According to the energy balance for the year 2005, biomass contributes by 6.2 % to the gross inland consumption. Biomass, in the form of wood and charcoal is almost exclusively used in the domestic sector. Industrial or other uses are very small and represent less than 1% of the total biomass final energy consumption.

Solar

The meteorological conditions in Republic of Macedonia are rather favourable for the use of solar energy (thermal, photovoltaics). There are meteorological data covering the cities of Bitola, Krusevo, Kumanovo, Prilep, Skopje and Stip and including the monthly average daily values of:

- the global solar irradiation on tilted surfaces (0° , 30° , 45° , 60°);
- the city water temperature;
- the ambient air temperature during the day and during the night.

7.2. National Policy for Renewables Deployment – Policy Instruments

According to the new Energy Law, in which there is a separate chapter on energy efficiency and renewable energy sources, the Government of the Republic of Macedonia creates the policy for improvement of energy efficiency and for the exploitation of renewable energy resources. With this chapter, the responsibilities of the Government of the Republic of Macedonia for adoption of a Strategy for Renewable Energy Resources Exploitation for the period of 10 years is defined. The Strategy will define the aims of renewable energy resources exploitation and the modalities of achieving these aims, namely: the potential of renewable energy resources, the feasibility for exploitation of the potential, the target volumes and timeline for the consumption electricity from renewable energy resources in the energy balance, defining transitional measures for support of exploitation of renewable resources, including preferential tariffs for preferential producers of electricity, and other support mechanisms.

The Energy Agency will be responsible for supporting the Government for preparation of the Strategy, and also for the preparation of implementation programmes.

The local policy will be established within local programmes for renewable energy resources which have to be in accordance with the Strategy for Renewable Energy Resources Exploitation.

In October 2004 the Government of the Republic of Macedonia allocated approximately EUR 65 000 from the Swiss Counterpart Fund for preparation of a Study on utilizing renewable energy sources in the Republic of Macedonia. This Study should comprise assessment of the renewable energy sources in the country, recommendations for possible investments in application of RES, assessment of the financial and energy implications of using RES, recommendations for creation of suitable legislation for regulation, promotion and motivation for RES, harmonized with the respective EU regulations and directives.

7.3. Renewables Policy Implementation

The Energy Agency of the Republic of Macedonia will give its support to the Ministry in the elaboration of the Programme for the implementation of the Strategy for Renewable Energy Resources Exploitation and development of the Rulebook on the exploitation of renewable energy resources.

The Energy Agency will issue and maintain a registry of guarantees of origin for electricity produced from renewable energy resources and from high-efficiency cogeneration facilities in the Republic of Macedonia and guarantees of origin associated with imports of electricity issued by other authorised national bodies.

8. ENERGY AND ENVIRONMENT

8.1. General Trends and Objectives

The Law on Environment incorporates the principle of sustainable development. It says that when an activity is undertaken or performed, care shall be taken as to the rational and sustainable use of natural resources so as to ensure that needs for a healthy environment, as well as the social and economic needs of the present generations are satisfied without jeopardising the rights of future generations to satisfy their own needs.

For the purpose of harmonizing economic development, social progress and environmental protection on national level, the Government of the Republic of Macedonia may develop National Strategy for Sustainable Development. The National Strategy for Sustainable Development shall be adopted by the Government of the Republic of Macedonia, which shall prior to adoption submit it to the Assembly of the Republic of Macedonia for review.

For the purpose of harmonizing economic development, social progress and environmental protection on national level, Local Agenda 21 can be adopted, as a local strategic, planning and programme document for sustainable development, in accordance with the principles of sustainable development.

EE criteria shall be followed during the implementation of the provisions of the Law on Environment with regard to the environmental impact assessment, issuing of integrated pollution and prevention licenses and in the part of introducing European environmental management scheme and environmental audits and eco-labeling. The Law on Environment from 2005 includes environmental impact assessment provisions and lists of projects, requiring an EIA.

The Republic of Macedonia has initiated the establishment of a System of Integrated Pollution Prevention and Control (IPPC) by the transposition of the EU IPPC Directive in the Law on Environment, introducing the concept on Best Available Techniques (BAT), which also takes into account energy efficiency. Three Chapters of the Law refer to:

- Integrated environmental permits concerning the operation of installations causing impacts on the environment;
- General environmental audit; and
- Compliance permits based on operational plans.

The Law on Environment also regulates this field and obliges the Ministry of Environment and Physical Planning to support legal entities and natural persons performing economic or other activities, scientific and educational organizations and institutions, as well as state administrative bodies, which organize the protection of the environment on voluntary basis, in compliance with the European environmental management scheme and environmental audits.

The Law foresees that the Ministry of Environment and Physical Planning adopts special regulations to define the environmental management scheme and environmental audits. The adoption of this regulation will reinforce the implementation of the EU legislation concerning the environmental management scheme and environmental audits.

In addition, the Institute for Standardization of the Republic of Macedonia has set up a Committee responsible for the development and adoption of environmental management and environmental audit standards in compliance with the ISO 14000 standards. The MKS ISO 14001 and the MKS ISO14050 standards have been developed and adopted so far. There are several companies in the Republic of Macedonia that have been certified by international certification companies in accordance with ISO 14001.

The Law on Environment includes eco-labeling provisions and foresees the adoption of secondary legislation which will prescribe the procedure, the conditions for and the manner in which it will be awarded and used. The Law also foresees the adoption of special regulations which will define the environmental criteria for certain groups of products. The bylaws have been drawn up and are now in the process of consultation with other authorities and stakeholders. They transpose the European Regulation No. 1980/ 2000 of the revised scheme for EU eco-labeling.

Climate change policy

The basic principles in the Climate Change policy are contained in the general principles of the Law on Environment. The Law stipulates that for the purpose of stabilization of green house gases concentration on a level that would prevent dangerous anthropogenic impact on the climate system within a time frame sufficient to

allow the ecosystems to naturally adapt to the climate change, in accordance with the principle of international cooperation and the goals of the national social and economic development, a National Plan for mitigation of climate change shall be adopted.

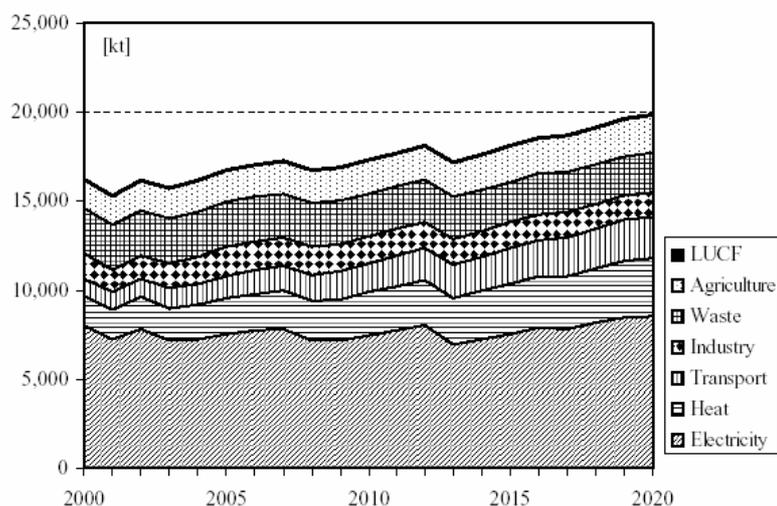
The Republic of Macedonia has prepared the First National Communication on Climate Change, which was submitted to the UNFCCC Secretariat in March 2003. The Communication is available on the website of the United Nations Framework Convention on Climate Change (www.unfccc.int), as well as on the national website (www.unfccc.org.mk). The developing the Second National Communication is on-going process in the Republic of Macedonia, coordinating by the Ministry of Environment and Physical Planning (MoEPP).

The Republic of Macedonia ratified the Kyoto Protocol in July 2004. The process of establishment of Designated National Authority (DNA) for the implementation of projects using the Clean Development Mechanism (CDM) under the Kyoto Protocol is an on-going activity of the MoEPP.

The First National Communication on Climate Change contains a national inventory and projections of greenhouse gas (GHG) emissions and sinks for the following gases: CO₂, CH₄, N₂O, for the 1990-1998 period, with 1994 as a baseline year. The energy sector is the most important source of GHG emissions with a share of 70%.

Share of CO ₂ (equivalent) emissions	Energy sector	Industrial activities	Agriculture	Waste	Land use change and forestry
	70%	7%	14%	8%	1%

According to the baseline scenario for future greenhouse gas emissions, in comparison to the emissions in 1990 (15512 kt CO₂-eq), the projected emissions will rise by 17% in 2012 (18136 kt CO₂-eq), and by 28% in 2020 (19.851 kt CO₂-eq). The energy sector provides the highest GHG abatement potential. In regard to industrial activities, there are three sectors whose activities in particular lead to GHG emissions: metal production (56.8%), mineral production (35.5%), and chemical industry (7.8%).



projections of greenhouse gas emissions (expressed in CO₂-eq) for each sector until 2020.

Acidification and other emissions

On the national and local level air pollution is of particular concern in urban areas. Thus, it has a potential impact on a large part of the population. The main sources of air pollution in Macedonia are mobile sources (traffic), and stationary sources (industry and energy production together with central and residential heating). In the period 1990 to 1995, air emissions decreased by 50%. This was due to the overall recession and the decline in industrial production that followed the political changes. Since then, however, the trend is slowly reversing with modest, but steady, increases in the level of industrial activity. Air quality problems are particularly pronounced around the areas of major cities³, thus potentially affecting 60% of the total population.

Burning of fossils fuels and agriculture activities are the most significant human activities that lead to acidification, eutrophication and increased levels of ground level ozone through emissions of sulphur dioxide (SO₂), nitrogen oxide (NO_x), volatile organic compounds (VOC) and ammonia (NH₃).

The MEPP-MEIC operates an air-monitoring network. The monitoring stations are designed to measure concentrations of SO₂, NO_x, and smoke on a continuous basis. The Hydro meteorological administration (HMA) runs a network that consists of 19, manually operated, air-monitoring stations. The parameters measured in this network include SO₂ and soot. Also, concentrations of NO_x and O₃ are measured at two of the sites; the ones in Skopje and Lazaropole⁴.

Table: Air pollution emission by sectors⁵

SECTORS	2002				2003			
	SO ₂ t/year	NO _x t/year	CO t/year	Dust t/year	SO ₂ t/year	NO _x t/year	CO t/year	Dust t/y
Sector 1 Combustion and power transformation in electricity generation plants (stationary sources)	90276	12267	1642	2064	91884	13447	1642	2064.4
Sector 2 Non-industrial combustion plants (stationary sources)	6298	1130	1846	326	6298	1130	1846	326
Sector 3 Combustion in manufacturing industry (stationary sources)	5400	1510	1942	1830	5400	1510	1942	1830
Sector 4 Production processes (stationary sources)	30660	4167	4730	1240	30880	6221	5267	24312
Sector 5 Solvent and other product use	3980	1420	16594	145	3980	1420	16594	145
Sector 6 Road transport and other mobile sources and machinery	514	11348	49305	67	514	11348	49305	67
TOTAL emissions	137128	31842	76059	5672	138956	35076	76596	28744

Source: MEPP, MEIC SOER for the Republic of Macedonia 2003

As can be seen, almost two thirds of the total annual SO₂ emissions derive from the combustion and transformation of energy whereas energy production and mobile sources are the major sources of emissions of NO_x. The single most important contributor to dust emissions is the industrial production processes and road traffic is the major source of CO emissions.

³ Skopje, Veles, Bitola, Tetovo and Kumanovo

⁴ Since 1977, Macedonia has operated an European Monitoring and Evaluation Program (EMEP) station at Lazaropole at an altitude of 1332 m above sea level.

⁵ The data on emissions from mobile sources, agriculture and waste are not complete

As a result of obsolete equipment and lack of modern technologies, the industrial sector is a major air polluter. The main pressures derive from activities in the metallurgy sector⁶, and the chemical industry⁷.

Energy production from thermal power plants and district heating facilities are other sectors whose activities severely affect air quality.

The level of air emissions from mobile sources depend not only on the level of activity, but also to the quality of the fuel that is used as well as to age structure of the vehicle fleet.

Ozone-depleting substances (ODS) have been reduced by 90% compared to the total consumption during the period 1995-2000. This is a result of the national action to phase out the ODS.

Other relevant energy-environment aspects

The Law on Ambient Air Quality⁸ provides for the adoption of limit values; margins of tolerance; target values; and upper and lower assessment thresholds for individual pollutants as specified by the EU Framework Directive 96/62/EC. Furthermore the MEPP has begun to develop the secondary legislation on ambient air quality thereby providing for harmonization with the Framework Directive on Air Quality 96/62/EC, and with the related daughter Directives⁹. The national air quality management plan is confirmed as one of the obligations that must be implemented in the forthcoming period.

Additional important steps are needed towards issuance of the secondary legislation¹⁰ with an emphasis on those elements that are of particular relevance in the Macedonian context including Directive 2004/107/EC on arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons. The EU Directive on National Emission Ceilings for Certain Atmospheric Pollutants must be transposed thereby setting national emission ceilings for acidifying and eutrophying substances in line with the relevant Directive and for ozone precursors particularly related with the implementation of IPPC Directive. Furthermore, the implementation of the Directive on Volatile Organic Compounds (VOC) emissions constitutes a major potential challenge.

In 2003 the “Master Plan for Phase out of Leaded Petrol” was developed. The Master Plan takes into account the Directive 98/70/EC on the quality of petrol and diesel fuels together with EU Decision 2000/159/EC, and Directive 96/62/EC on air quality.

The Republic of Macedonia is a party to the Convention on Long-range Transboundary Air Pollution and the EMEP Protocol (European Monitoring of Environment Programme). There is however a need for a thorough analysis of the Convention’s Protocols on SO₂, NO_x and VOCs in order to assess the available and required national

⁶ Lead and zinc smelter MHK Zletovo-Veles and ferro-alloy SILMAK-Jegunovce, Maksteel-Skopje, Balkan Steel-Skopje, Metalski zavod Larnica-Skopje, FENI Industries-Kavadarci

⁷ OKTA Refinery, OHIS chemical complex and TITAN cement factory

⁸ The Law establishes grounds for laying down ambient air quality limit values and alert thresholds, emission limit values for exhaust gases and vapours from stationary sources, emission limit values for exhaust gases from mobile sources, and contents of harmful substances in fuels (Official Gazette of RM No. 67/04)

⁹ The three “daughter” Directives 99/30/EC, 2000/69/EC, 2002/3/EC

¹⁰ Proces of preparation and transposition of the legislation is ongoing

capacities for their implementation. The requirements of these Protocols must be incorporated into the secondary legislation on ambient air quality.

MEPP completed the Cadastre of air polluters for Skopje in December 2004. The national Cadastre is scheduled for completion by the end of 2005. Through these efforts, the unique methodology of setting up pollution inventories in accordance with the CORINAIR (Core Inventory for Air Pollution) and SNAP (Selected Nomenclature for Air pollution) has been introduced.

8.2. Environmental Policy Implementation

In the framework of the efforts aimed at integration into the modern trends of environmental protection in Europe and wider, and also as an important segment of the process of reforms, the Government of the Republic of Macedonia established the Ministry of Environment in 1998. The establishment of this Ministry has enabled the development of environmental management system, accompanied by adequate institutional capacity and appropriate legislative framework that is implementation of one of the priority recommendations of the National Environmental Action Plan (NEAP). The Ministry has the following competencies by law:

- monitoring the state of the environment;
- proposing of measures and activities aimed at water resources, air and ozone layer protection, protection against noise, radiation, conservation of biological diversity, geological diversity, national parks and protected areas;
- remedial of polluted parts of the environment;
- cooperation with scientific institutions for development of standards and regulations to regulate environment protection;
- development of self-financing system from independent sources, types and levels of environmental charges and other payments;
- cooperation with civil associations, civil initiatives and other forms of civic activity;
- inspection supervision in the field of its scope;
- other activities specified by law.

8.3. Environmental Levies and Taxes

The Polluter pays principle as well as the user pays principle are one of the principles incorporated in the Law on Environment.

The Polluter pays principle imposes the obligation for the polluter to compensate for the costs of damage made in order to restore the environment, to the maximum extent possible, to the state before the damage.

The user pays principle is aimed at the user of resources compensating for the costs related to the sustainable development and environmental remedy resulting from the use of natural resources.

9. ASSESSMENT AND FUTURE PLANS

9.1. Successful Instruments

Adoption the new Energy Law in May 2006, in which a special “Energy Efficiency and Renewable Energy” chapter is included. The new Law is a basis for development of secondary legislation for improvement of energy efficiency and renewable energy use.

Institutional capacity building with establishment of Energy Regulatory Commission, and founding of the Energy Agency of the Republic of Macedonia.

9.2. Barriers

- Lack of available financing, or sources of funding, to implement an EE or RES projects;
- Lack of financial institutions experience in evaluating and financing EE and RES projects;
- Lack of institutional capacities for implementation the EE and RES strategies and programmes;
- Lack of information on what types of EE and RES projects might be benefit to company;
- Low electricity price does not justify the investment in EE or RES projects;
- Lack of EE and RES service provides (companies that offer technical or financial services) in the marketplace.

9.3. Improvements

There are several steps undertaken for energy efficiency improvements and promotion of renewable energy:

- Adoption the Energy Efficiency Strategy of the Republic of Macedonia until 2020, in October 2004;
- Adoption the Law for constitution the Energy Agency of the Republic of Macedonia, in July 2005;
- Establishment the Energy Agency of the Republic of Macedonia, in January 2006;
- Adoption the new Energy Law, in May 2006;
- Setting the Sustainable Energy Financial Facility for co-financing EE and RES projects, in May 2006;
- Founding the first ESCO in the Republic of Macedonia, in June 2006.

9.4. Recommendations

The European Commission Conclusion for the Energy Chapter in the ANALYTICAL REPORT for the opinion on the application from the Republic of Macedonia for EU membership (9.11.2005):

“Particular efforts are needed in the area of legislation on internal electricity and gas markets, energy efficiency and renewable energy sources. The country's administrative capacity should be significantly strengthened in all energy sectors.”

10. CONSULTED SOURCES

- 1) Answers to the European Commission's Questionnaire 2005
- 2) Energy Efficiency Strategy of the Republic of Macedonia until 2020
- 3) New Energy Law, 2006
- 4) Energy Balance 2005
- 5) Statistic Year Book

**Energy Charter Protocol on Energy Efficiency and
Related Environmental Aspects PEERA**

Republic of Macedonia¹¹

REGULAR REVIEW 2006

Part II:

**Indicators on Energy, Energy Efficiency,
Economy and Environment**

¹¹ The State to which this report relates has been admitted to membership of the United Nations under General Assembly Resolution 47/225 as the Former Yugoslav Republic of Macedonia.

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a. Introduction

This document is Part II of the Review Format of the Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects (PEEREA). Part I covered qualitative data on energy and energy efficiency policies, measures and instruments, and actors. This part focuses on quantitative data.

The tables include data relevant to the use of energy. Furthermore information is asked on end-use energy prices and CO2 emissions.

Conversion of units:

Units are converted to Mtoe using the general conversion factors for energy.

b. Macro-Economic Data

Table b.1 Gross Domestic Product

Please indicate the GDP and GDP (PPP) (adapted with the Purchasing Power Parity – PPP) of your country for the years below in billion US \$. The figures presented should be based on 1995 prices and 1995 USD exchange rates (use IEA/OECD data, where available).

(billion US\$95)

	1992	1995	1999	2000	2001	2002	2003
GDP		4.456	4.960	5.185	4.951	4.993	5.133
GDP (PPP)	12.379	12.165	...

Sources: State Statistical Office

Table b.2. Number of inhabitants

(millions)

	1990	1995	1999	2000	2001	2002	2003
Population	2.03	1.97	2.02	2.03	2.03	2.02	2.03

Sources: State Statistical Office

c. General Energy Data

Table c.1.

(ktoe)

Indicators	1992 ¹²	1995	1999	2000	2001	2002	2003 ¹³
Total Primary Energy Production		1 671	1 698	1 595	1 642	1 577	
Net imports		1 104	1 009	1 104	1 011	1 486	
Total Primary Energy Supply (TPES)		2 694	2 837	2 765	2 677	2 892	
Total Final Consumption (TFC)		1 610	1 670	1 610	1 439	1 791	
TFC/GDP (toe/thous.US\$)		0.361	0.337	0.311	0.291	0.359	
Total Electricity Consumption*		427	440	448	431	428	
Electricity produced from RES*		69	119	101	54	65	
Heat produced from RES**		3	6	6	5	4	

Sources:

* 1 Mtoe = 11.63 TWh

** 1 Mtoe = 4.1868x10⁴ TJ; 1 Mtoe = 10⁷ Gcal

¹² The energy data from 1990 are under preparation, and deadline for completing is end of 2006.

¹³ The energy data from 2003 are under preparation, and deadline for completing is September 2006.

d. Sector Consumption: Parameters and Energy Efficiency Indicators

Table d.1. Total Final Energy Consumption (TFC) by end-use sector

(ktoe)

Sectors	1992	1995	1999	2000	2001	2002	2003
Residential		435	456	485	442	452	
Industry		543	499	535	458	438	
Services		137	256	161	118	482	
Transport		385	411	368	349	376	
Agriculture		71	48	56	58	32	
Others*		38	0	5	16	11	
Total (TFC)		1.610	1.670	1.610	1.439	1.791	

Sources: State Statistical Office

* Others include Non-specified other sectors and Non-energy use

Table d.2. Energy Efficiency Indicators for Households: Final Consumption of the Residential Sector by Energy Source

(ktoe)

Indicators residential sector	1992	1995	1999	2000	2001	2002	2003
Total Final Consumption		435	456	485	442	452	
a. Electricity		205	226	228	223	231	
b. Heat		30	39	36	38	40	
c. Oil products		27	31	33	34	36	
d. Gas		0	0	0	0	0	
e. Coal		7	7	6	4	5	
f. Combust. Renew. & Waste		167	153	182	142	140	
g. Others		0	0	0	0	0	
Floor Area ('000 m ²)						49 672	
No. of dwellings						697 529	
Residential use per dwelling (toe/dwelling)						0.648	
Residential use per surface (toe/m ²)						0.009	

Sources: State Statistical Office

Table d.3: Final Consumption of the Industry Sector by Energy Source in 2003

(ktoe)

Indicators industrial sector	Mining	Manufacturing							Construction	Total
		Iron and steel	Chem. and petrochemical	Non-ferrous metals	Food and tobacco	Paper pulp and print	Non-metallic minerals	Other		
Coal										
Petroleum products										
Gas										
Electricity										
Heat										
Combust. Renew. & Waste										
Total										
Value added per sector (1995 USDx10 ⁶)										
Energy/value added (Mtoe/10 ⁶ USD)										

Sources:

Table d.4. Energy Efficiency Indicators for Services (commercial and non-commercial): Final Energy Consumption of Services by Energy Source

Indicators services sector	(ktoe)						
	1992	1995	1999	2000	2001	2002	2003
Total Final Consumption		137	256	161	118	482	
a. Electricity		44	75	81	73	78	
b. Heat		16	13	15	15	17	
c. Oil products		73	135	41	29	380	
d. Gas		0	0	0	0	0	
e. Coal		1	14	1	1	5	
f. Combust. Renew. & Waste		1	17	20	0	0	
g. Others		2	2	2	0	1	
No. of employees	335 350	338 015	355 460	341 830	297 900
Floor area ('000 m ²)
Value added (10 ⁶ USD)							
Energy/value added (Mtoe/10 ⁶ USD)							
toe/Employee			0.764	0.476	0.331	1.409	
toe/m ²

Sources: State Statistical Office

Table d.5. Transport indicators (2003)

Indicators transport sector	Freight	Travel	Total
Total Final Consumption (Mtoe)			
10 ⁹ Tonne-km	4.130	-	4.130
TFC/10 ⁶ tonne-km		-	
10 ⁹ Person-km	-	1.344	1.344
TFC/person-km (TFC/10 ⁶ person-km)	-		
Number of cars/1000 inhabitants		148	

Sources: State Statistical Office

e. End-Use Energy Prices for Various Market Sectors

Table e.1. Energy prices for end use sectors 2003

(USD per Unit)

Sectors	Un-leaded gasoline 95 RON (litre)	Light fuel oil ('000 litres)	Diesel (litre)	Heavy fuel oil (tonne)	Nat. Gas (10 ⁷ kcal GCV*)	Steam Coal (tonne)	Electricity (kWh)
Industry	0.8289	478.38	0.6497	195.55	211.14		0.0462
Households (Incl. ...% VAT)	0.9781	564.49	0.7667	230.75	-		0.0496
Electricity generation	-						-

* Gross Calorific value

Sources: Energy Regulatory Commission of the Republic of Macedonia

f. CO₂ Emissions

Table f.1. CO₂ emissions from fuel combustion

Indicators	1990	1995	1999	2000	2001	2002	2003
Total CO ₂ emissions (Mtonnes/year)		9.037		8.838		9.318	
Share electricity and heat production (%)		70.3		71.1		64.0	
Share residential sector (%)		1.2		1.4		1.4	
Share industrial sector (%)		10.3		12.1		9.3	
Share transport sector (%)		12.4		12.2		11.8	
Share other sectors (%)		5.8		3.2		13.4	
Total CO ₂ /GDP (kg/USD '95)		2.03		1.70		1.87	
Total CO ₂ /capita (tonnes/inhabitant)		4.6		4.36		4.61	
Total CO ₂ / TFC (tonnes/toe)		3.35		3.20		3.22	

Sources: State Statistical Office

**Energy Charter Protocol on Energy Efficiency and
Related Environmental Aspects PEEREA**

FYR of Macedonia
REGULAR REVIEW 2006

Part II:

**Indicators on Energy, Energy Efficiency,
Economy and Environment**

Based on IEA data

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a. Introduction

This document is Part II of the Review Format of the Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects (PEEREA). Part I covered qualitative data on energy and energy efficiency policies, measures and instruments, and actors. This part focuses on quantitative data.

The tables include data relevant to the use of energy. Furthermore information is provided on end-use energy prices and CO₂ emissions.

Conversion of units:

Units are converted to Mtoe using the general conversion factors for energy.

b. Macro-Economic Data

Table b.2 Gross Domestic Product

The figures presented are based on 2000 prices and 2000 USD exchange rates.

	(billion US\$2000)						
	1992	1995	1999	2000	2001	2002	2003
GDP	3.449	3.100	3.431	3.587	3.425	3.454	3.565
GDP (PPP)	13.038	11.458	12.714	13.309	12.695	12.752	13.152

Sources: IEA Energy Statistics, Electronic version 2005

Table b.2. Number of inhabitants

	(millions)						
	1992	1995	1999	2000	2001	2002	2003
Population	1.925	1.966	2.017	2.026	2.035	2.038	2.049

Sources: IEA Energy Statistics, Electronic version 2005

c. General Energy Data

Table c.1.

	(Mtoe)						
Indicators	1992	1995	1999	2000	2001	2002	2003
Total Primary Energy Production	1.742	1.810	1.629	1.532	1.572	1.510	1.564
Net imports	1.242	1.070	1.014	1.114	1.019	1.209	1.068
Total Primary Energy Supply (TPES)	2.930	2.771	2.765	2.710	2.608	2.596	2.681
Total Final Consumption (TFC)	1.656	1.552	1.662	1.610	1.442	1.550	1.635
TFC/GDP (toe/thous. US\$ 2000)	0.480	0.501	0.484	0.449	0.421	0.449	0.459
Total Electricity Consumption*	0.451	0.427	0.440	0.448	0.432	0.428	0.490
Electricity produced from RES* ¹⁴	-	-	0.119	0.101	0.054	0.065	0.118
Heat produced from RES** ¹⁵	-	-	0.006	0.006	0.005	0.004	0.004

Sources: IEA Energy Statistics, Electronic version 2005

* 1 Mtoe = 11.63 TWh

** 1 Mtoe = 4.1868x10⁴ TJ; 1 Mtoe = 10⁷ Gcal

¹⁴ From hydro

¹⁵ From combustible renewables and waste

d. Sector Consumption: Parameters and Energy Efficiency Indicators

Table d.1. Total Final Energy Consumption (TFC) by end-use sector

Sectors	1992	1995	1999	2000	2001	2002	2003
Residential	508	447	453	481	441	450	494
Industry	686	511	483	531	457	437	481
Services	53	69	234	143	119	231	254
Transport	274	336	407	363	345	360	347
Agriculture	61	142	48	56	57	33	25
Others*	73	46	37	35	24	39	35
Total (TFC)	1656	1552	1662	1610	1442	1550	1635

Sources: IEA Energy Statistics, Electronic version 2005

* Others include Non-specified other sectors and Non-energy use

Table d.2. Energy Efficiency Indicators for Households: Final Consumption of the Residential Sector by Energy Source

Indicators residential sector	1992	1995	1999	2000	2001	2002	2003
Total Final Consumption	508	447	453	481	441	450	494
a. Electricity	168	205	226	228	224	231	249
b. Heat	30	28	37	33	38	40	44
c. Oil products	116	20	33	34	35	36	39
d. Gas	-	-	-	-	-	-	-
e. Coal	7	8	4	4	3	3	3
f. Combust. Renew. & Waste	187	187	153	182	142	140	158
g. Others	-	-	-	-	-	-	-
Floor Area ('000 m ²)							
No. of dwellings ('000)							
Residential use per dwelling (toe/dwelling)							
Residential use per surface (toe/m ²)							

Sources: IEA Energy Statistics, Electronic version 2005

Table d.3: Final Consumption of the Industry Sector by Energy Source in 2003

(ktoe)

Indicators industrial sector	Mining	Manufacturing							Construction	Total
		Iron and steel	Chem. and petrochemical	Non-ferrous metals	Food and tobacco	Paper pulp and print	Non-metallic minerals	Other		
Coal	-	88	-	13	1	-	-	-	-	102
Petroleum products	2	29	-	-	5	-	86	5	4	131
Gas	-	27	1	-	1	-	1	-	-	30
Electricity	3	101	4	4	11	1	13	13	2	152
Heat	-	7	6	-	23	2	5	22	-	65
Combust. Renew.&Waste	-	-	-	-	-	-	-	1	-	1
Total	5	252	11	17	41	3	105	41	6	481
Value added per sector (2000 USDx10 ⁶)										
Energy/value added (Mtoe/10 ⁶ USD)										

Sources: IEA Energy Statistics, Electronic version 2005

Table d.4. Energy Efficiency Indicators for Services (commercial and non-commercial): Final Energy Consumption of Services by Energy Source

Indicators services sector	(ktoe)						
	1992	1995	1999	2000	2001	2002	2003
Total Final Consumption	53	69	234	143	119	231	254
a. Electricity	27	44	75	81	73	78	85
b. Heat	19	17	15	18	15	17	21
c. Oil products	-	-	133	41	29	131	134
d. Gas	-	-	-	-	-	-	-
e. Coal	6	6	9	1	1	3	8
f. Combust. Renew. & Waste	-	-	-	-	-	-	5
g. Others (geothermal)	-	2	2	3	-	1	-
No. of employees (mil.)							
Floor area ('000 m ²)							
Value added (10 ⁶ USD)							
Energy/value added (Mtoe/10 ⁶ USD)							
toe/Employee							
toe/m ²							

Sources: IEA Energy Statistics, Electronic version 2005

Table d.5. Transport indicators (2003)

Indicators transport sector	Freight	Travel	Total
Total Final Consumption (Mtoe)			0.347
10 ⁹ Tonne-km		-	
TFC/10 ⁶ tonne-km		-	
10 ⁹ Person-km	-		
TFC/person-km (TFC/10 ⁶ person-km)	-		
Number of cars/1000 inhabitants			

Sources:

e. End-Use Energy Prices for Various Market Sectors

Table e.1. Energy prices for end use sectors 2003

Sectors	(USD per Unit)						
	Un-leaded gasoline 95 RON (litre)	Light fuel oil ('000 litres)	Diesel (litre)	Heavy fuel oil (tonne)	Nat. Gas (10 ⁷ kcal GCV*)	Steam Coal (tonne)	Electricity (KWh)
Industry							
Households (Incl. ...% VAT)							
Electricity generation	-						-

* Gross Calorific value

Sources:

f. CO₂ Emissions

Table f.1. CO₂ emissions from fuel combustion

Indicators	1990	1995	1999	2000	2001	2002	2003
Total CO ₂ emissions (Mtonnes/year)	9.15	8.81	8.85	8.47	8.58	8.20	8.23
Share electricity and heat production (%)							68.65
Share residential sector (%)							1.58
Share industrial sector (%)							11.54
Share transport sector (%)							12.27
Share other sectors (%)							6.08
Total CO ₂ /GDP (kg/USD 2000)	2.33	2.84	2.58	2.36	2.51	2.37	2.31
Total CO ₂ /capita (tonnes/inhabitant)	4.81	4.48	4.39	4.18	4.22	4.02	4.02
Total CO ₂ / TFC (tonnes/toe)	5.52	5.68	5.32	5.26	5.95	5.29	5.03

Sources: IEA Energy Statistics, CO₂ Emissions from Fuel Combustion (2005 Edition)