



# ARMENIA

## Regular Review of Energy Efficiency Policies 2005



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

**Armenia**

**REGULAR REVIEW 2005**

**Part I:**

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

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## EXECUTIVE SUMMARY

The Republic of Armenia is a small country strategically located at the crossroads between Europe and Asia. The country has an area of 29800 km<sup>2</sup> and borders on Turkey in the west, Georgia in the north, Azerbaijan in the east (and the Nakhichevan Region in south-west), and Iran in the south. By a current official estimate, the population of Armenia is now 3.2 million people, with an annual growth equalling 0.7%.

In accordance with the Constitution adopted by a nation-wide referendum on July 5, 1995, Armenia is an independent and democratic nation with a presidential form of administration. The President is elected by a national vote for a term of five years. The executive authority is the Government of Armenia, headed by the Prime-Minister who is appointed by the President. The legislative authority is the National Assembly (composed of 131 deputies elected for a four-year term of office).

The mountains in Armenia are rich in copper, molybdenum, lead, clay, limestone and semi-precious stones. Armenia is also rich in natural sources of mineral water. There are hundreds of them in the country. Armenia has ten natural lakes, five canyons and numerous springs and mountainous rivers. The Sevan Lake is the world's largest mountainous pool of sweet water (with a surface of 1400 m<sup>2</sup>). Armenia's highest mountain is the Aragats (4090 m).

Total primary energy supply in Armenia stood at 3.15 Mtoe in 2004 and the country produced only 36.5% of that amount. The installed capacity of all power plants in the country is 3.203 million kW. Heat is largely generated by thermal power plants, while the heat only boilers are currently not in operation.

During 1990-1995 both the national GDP and power consumption plummeted. This made the economy less energy intensive to a certain extent and was caused by the transition problems. During the following period of 1996-2000, the state implemented serious steps to manage the economic crisis, which were envisaged in the adopted strategic documents on the social and economic development of the country and, *inter alia*, its energy sector.

During 2001-2004, Armenia virtually completed the restructuring of the vertically integrated energy sector, displayed steady trends towards financial revitalization of the energy system, privatised the majority of energy companies and saw the beginning of an energy consumption pickup.

Armenia continues to depend on Russia (for energy, especially natural gas, imports) and Georgia (due to the trade embargo imposed by Azerbaijan and Turkey the majority of imports have to transit via Georgia). Efforts to diversify primary energy supplies through a proposed gas pipeline from Iran have been successful. The construction of the first 40-km segment of the Iran-Armenia gas line began in November 2004. The Government of Armenia is using its best endeavours to construct the entire pipeline (about 200 km) with its completion slated for the end of 2006.

Armenia has a rather well-developed gas transmission infrastructure. In the 1980's, it was one of the world's most advanced countries in terms of gas supply covering over 85% of users.

Rapid growth of social and economic indicators in Armenia in the recent years has been conducive to an increase in demand for natural gas and electricity on the domestic market. In particular, demand for natural gas has grown virtually in all economic sectors. In 2002-2004, gas demand grew by an average of 1.3% p.a. in the power sector, 21.5% p.a. in the industry, 57.1% p.a. in households and 12.25% in other sectors. The growth of natural gas supplies during the same period averaged 12.25% p.a.

There is a steady trend towards growing demand for electricity on the domestic market, which averaged 8.7% p.a. during 2002-2004 while generation grew by 4.6% p.a. The difference between the consumption and generation growth rates has resulted from the large-scale actions to improve power grid efficiency and reduced process and commercial electric losses in power grids.

The first Energy Law was adopted in 1997 and followed by an updated version in March 2001 which laid down the relevant legal framework for a successful restructuring of the Armenian vertically integrated energy system and a large-scale privatisation of energy companies.

The intent of the Energy Saving and Renewables Law adopted in 2004 is to formulate and ratify the government policy framework for energy saving activities and advancement of renewables with a view to:

- strengthen the economic and energy independence of Armenia;
- enhance the reliability of the Armenian energy system;
- create new manufactures and services to facilitate energy saving and promote renewables; and
- reduce man-made impacts on the environment and human health.

A decree that has now been submitted to the Prime Minister for approval provides that a National Energy Saving Programme which is indispensable for Armenia will be developed within two years to specify and, *inter alia*, quantify the key energy saving targets for both the energy industry and other economic sectors.

Final energy efficiency priorities can be determined after the National Energy Saving Programme is finalised. However, in this report a preliminary review indicates the following:

The first priority in the area of energy efficiency is the industrial sector which consumes 40% of all primary energy, with its major target constituents including the power, mining, chemical and construction materials industries.

The second priority area is the transport sector consuming 24% of all primary energy given its increasing annual consumption, the degree of its adverse environmental impacts and the quantities of emitted hazardous substance and GHG emissions.

The third priority area includes the residential sector accounting for 15% of the total energy consumption. Despite the considerable expected potential in this sector, the implementation of energy saving measures is constrained by its large investment requirements and the socially disadvantaged status of the population.

Agriculture is seen as a fourth priority, accounting for 4% of the total energy consumption. Implementation of measures is constrained by the lack of sufficient funding in rural areas and the absence of highly qualified personnel in the farm produce processing sector.

## 1. INTRODUCTION

The Republic of Armenia is located in the Trans-Caucasus, belongs to the transit economies category and was part of the USSR until the end of 1991. The area of the country equals 30000 km<sup>2</sup>. As of the beginning of 2002, its population stood at 3.2 million inhabitants. The capital of the Republic of Armenia is Yerevan.

The Republic of Armenia is a landlocked country and borders on Georgia, Azerbaijan, Turkey and Iran.

The Republic of Armenia is situated within the sharp continental climate belt. The climate specifics of the country are a function of its geographic location in low latitudes and mountainous terrain.

Armenia was one of the first nations that gained independence following the collapse of the Soviet Union in 1991, which embarked on the path of democratic reform and transition from central planning to a market-driven economy. Armenia managed to make a success of liberalizing the implementation of a number of structural reforms. The economy is developing at a rapid pace and in the recent years the growth of GDP has begun to be expressed in two-digit numbers, amounting to 10.5% p.a. in the past three years. Inflation remains low and the budget deficit has been greatly reduced. There was also a considerable decrease in the deficit of current accounts in 2004. Armenia became an official WTO member in February 2003.

A review of the main economic developments and fuel consumption during 1990-2004 displays three phases characterised by different energy trends.

The first phase covers 1990-1995. It is characterised by a sharp decline in GDP and fuel consumption and an energy crisis. Commencing in 1991, a blockade of Armenia, frequent subversive disruptions of the only main gas pipeline and a shutdown of the Armenian nuclear power plant resulted in the country's deep energy crisis that lasted until the second unit of the Armenian Nuclear Power Plant resumed operations at the end of 1995. The Energy Ministry of the Republic of Armenia was established in 1992 with a view to improve management efficiency and commence and lead the way for demonopolisation and reform in the energy sector.

The second phase covered 1996-2000 and featured the priority of ensuring sustained, reliable and safe operations of the power grid in general and the nuclear power plant in particular and overcoming the aftermath of the energy crisis. Armenian energy sector restructuring initiated by the Energy Ministry was the key to energy crisis management. The phase was characterized by a slower pace of falling of the fuel consumption.

During the third phase that embraced 2001-2004, the country virtually completed the restructuring of the vertically integrated energy sector, displayed steady trends towards financial revitalization of the power system, privatised the majority of energy companies and saw the beginning of an energy consumption pickup.

The key principle of the energy strategy adopted by the Armenian Energy Ministry includes ensuring sustainable development of the energy sector based on the prevailing economic trends and expanded regional cooperation prospects, taking into account the experience gained by the energy sector, as well as with the maximum use of energy efficient technologies both in the energy industry itself and the other economic sectors.

A Strategy for Energy Sector Development until 2025-2030 in the Context of Sustainable Development of the Republic of Armenia was developed in 2005 and is now under scrutiny by the Government of the Republic of Armenia. The core element of the strategy includes ensuring a reasonable level of the nation's energy security. Armenia that has overcome the grave energy crisis has learned the lessons of a loss of energy security. The energy security strategy is based on the implementation of a three-tier diversification that envisions:

- the use of varied generating capacities to produce electric power (hydro, thermal and nuclear);
- supply of the economy and the energy sector with the necessary variety of fuel and energy resources (natural gas, oil products, nuclear fuel, renewables);
- ensuring reliable (diversified) deliveries of fuel and energy resources through the use of gas and oil pipelines, railways, motor roads and power lines.

## **2. BACKGROUND: ENERGY POLICIES AND PRICES**

### **2.1. Energy Policy - General Trends and Objectives**

A Strategy for Energy Sector Development until 2025-2030 in the context of sustainable development of the Republic of Armenia has now been developed and submitted for review by the Government.

Armenia is almost fully dependent on energy imports. The only primary energy produced in the country is electricity generated by hydro power plants and one nuclear power plant. In this connection, the Armenian energy strategy provides for both fuel and energy supplies from abroad and further development of internal renewable energy resources. As to oil product imports, there is a severe constraint because these may only be brought in via Georgia and Iran because the Turkish and Azerbaijani borders are closed. At the present time, nearly all gas and oil product imports come from Russia.

Given that it was developed after a serious recession and the energy crisis, the Energy Policy Programme of Armenia approved by the Government in January 1994 focused on the following areas:

- adoption of an Energy Law;
- energy sector rehabilitation and development strategy;
- energy pricing, taxes and other financial matters required by a free market;
- electricity and heat price regulation during the transition period;
- potential funding sources; and
- environmental protection.

In the years that followed, the Programme was practically implemented.

The first Energy Law was adopted in 1997 and followed by an updated version in March 2001. The Energy Law sets forth the following government energy policy priorities:

- improved energy sector competition and efficiency and creation of the necessary conditions for establishing a competitive environment;
- regulation in the energy sector;
- separation of economic activities and government control and regulation functions;
- protection of consumer and business entity rights in the energy sector and ensuring a balance of their interests;
- efficient use of national energy resources and alternative sources of energy and application of economic and legal mechanisms for this purpose;
- provision of incentives for investment in the energy sector;
- ensuring transparency of licensed operations in the energy sector;
- ensuring energy security;
- strengthening of Armenia's energy independence, inter alia, through diversification of local and imported energy resources;
- protection of the environment;
- encouraging technical change and introducing new energy efficient and energy saving technologies, as well as education and training;
- promotion of energy market formation and development; and
- unbundling of generation, transmission/transportation, distribution, export, import, system operator and service provider functions on the energy market.

Activities in the energy sector are regulated by a Public Services Regulatory Commission (the "Commission"). The Commission is independent from the executive power in the Republic and operates on the basis of the Public Services Regulator Law, the Energy Law, and the Licensing Law.

The regulation philosophy provide for the following:

- a. regulation by an independent body within the limits of authority vested by the law;
- b. public transparency of regulation;
- c. non-discrimination of consumers or licensees;
- d. balance of interests between consumers and energy market players;
- e. collectiveness of regulator decision-making; and
- f. setting limits on regulation – progressively in parallel with the development of a competitive market.

The main instruments of regulation include the following:

- a. licensing, approval of licensing terms and conditions and monitoring of compliance;
- b. for the purpose of reporting to the regulator – introduction of licensee accounts and sub-accounts pursuant to the National Accounting Plan, legal acts and laws relating to accounting;
- c. regulated tariff setting;
- d. development of agreements formats and compulsory terms and conditions between licensees for electricity and/or natural gas supplies (performance of services), as well as the supply (contracts of sale) of consumers with electricity and natural gas; registration of contracts between licensees;
- e. approval of market rules and regulations;
- f. approval of legal acts by the regulator within the limits of its authority; compliance oversight;
- g. determination of service quality requirements;
- h. review of investment development programmes submitted by license holders to factor or not investment (in full or in part) in future rate-setting methodologies.

In 1997-1998, the Government started a power grid reform. The restructuring of the vertically integrated power grid in Armenia has led to the formation of the following closed joint stock companies: generators; a high voltage transmission company; a power distributor; a settlement centre; and a power grid operator.

Privatisation of businesses in the sector is progressing on a fast track. To date, all repair and construction entities have been privatised, with the privatisation of design entities nearing completion. All previously constructed small hydro power plants have been privatised. Privatised among large energy companies are the Vanadzor Thermal Power Plant (TPP), Sevan-Razdan Hydroelectric System, Razdan Thermal Power Plant and the power distributor. The gas transmission and distribution networks have also been privatised. In the near future, the power transmission company, the settlement centre, the power grid operator or the Armenian Nuclear Power Plant (NPP) will not be made subject to privatization.

Market relations in Armenia are governed by the Energy Law. The Law governs the relationships between government authorities and business entities in the energy sector, including electricity, heat and natural gas pricing, energy licensing and energy supplier/consumer relations.

Energy market players are as follows:

- Armenian Power Grids Closed Joint Stock Company (CJSC)
- Settlement Centre CJSC;
- Generating companies (Armenian Nuclear Power Plant CJSC, Razdan Thermal Power Plant CJSC, Yerevan Thermal Power Plant CJSC, Sevan-Razdan Hydroelectric System CJSC, and Vorotan Hydroelectric System CJSC);
- High Voltage Power Grid CJSC;

- Power Grid Operator CJSC;
- ArmRosgazprom CJSC.

The economic relationships between energy business entities in the Republic are based on direct contracts of sale between the fuel (natural gas) supplier, generators and the only distribution company. There are plans to make the wholesale electricity market accessible for large consumers effective 2006.

The government policy in the electricity sector is conducted by the Government of the Republic represented by the Energy Ministry and Public Services Regulatory Commission.

Construction of new energy facilities is planned by private investors in accordance with the BOO and BOOT schemes and by the Government with the attraction of investment in the form of soft loans. One example of such new energy construction is a large, 208 MW combined gas-and-steam unit at the Yerevan Thermal Power Plant, which is to be funded with a loan provided by the Government of Japan through the Japanese Bank for International Cooperation (JBIC).

International observers give favourable appraisals of the Energy Ministry leadership of the energy sector reform.

Domestic energy resources in Armenia are limited to hydro and nuclear power which accounted for about 36.5% of total primary energy in 2004. The country's reliance on energy imports is considerable.

The Republic continues to depend on Russia (for energy, especially natural gas, imports) and Georgia (due to the trade embargo imposed by Azerbaijan and Turkey the majority of imports have to transit via Georgia). Efforts to diversify primary energy supplies through the construction of an Iran-Armenia gas pipeline have been successful. The construction of the first 40-km segment of the Iran-Armenia gas line within Armenia began in November 2004. The Government of Armenia is using its best endeavours to construct the entire pipeline (about 200 km) with its completion slated for the end of 2006.

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Rapid growth of social and economic indicators in Armenia has been conducive to an increase in demand for natural gas and electricity on the domestic market. In particular, demand for natural gas has grown virtually in all economic sectors. In 2002-2004, gas demand grew by an average of 1.3% p.a. in the power sector, 21.5% p.a. in the industry, 57.1% p.a. in households and 12.25% in other sectors. The growth of natural gas supplies during the same period averaged 12.25% p.a.

The high rate of payment collection which has never dropped below 100% in the recent years is indicative of the efficient operations of ArmRosgazprom CJSC.

The above referenced indicators have been achieved with an impressive pace of reinstated consumer gas supply which totalled 45.1% in 2004 alone. Completion of gas supply reinstatement and full gas supply coverage of users are slated for 2008. Full coverage will contribute to the reinstatement of residential heating. District heating virtually collapsed during the energy crisis. It is being rehabilitated at a slow pace

because of the large investment requirements and low financial solvency of the population. In parallel with district heating rehabilitation, the Government considers and offers to users individual and local heating alternatives that are compliant with environmental requirements.

There is a steady trend towards growing demand for electricity on the domestic market, which averaged 8.7% p.a. during 2002-2004 while generation grew by 4.6% p.a. The difference between the consumption and generation growth rates has resulted from the large-scale actions to improve power grid efficiency and reduced process and commercial electric losses in power grids.

The main generation capability is concentrated in the Armenian Nuclear Power Plant (408 MW) and thermal power plants (1756 MW), in particular the Razdan TPP. Before the collapse of the Soviet Union, it was the NPP and the Razdan TPP that were charged with the role of the base load power suppliers to the Trans-Caucasus integrated power grid.

At present, the Razdan TPP operates with underutilised installed capacity and a semi-peak load pattern, which seriously deteriorates its performance. It is obvious that electricity exports from the Razdan TPP to foreign markets will improve the performance of the plant, including natural gas use efficiency.

The Armenian power grid has a well-developed infrastructure with interconnections to the power grids of all neighbouring countries. Armenian high voltage power grids have sufficient throughput capacity not only for domestic power transmissions but also for large transit volumes. Prompt integration of the regional power grids will also contribute to improved efficiency of the Armenian power system.

With the growing demand for electricity and considerable reduction of commercial losses, marketing operations performed by the privatised company “Armenian Power Grids” are becoming more efficient. Payment collection improved by an average of 3.2% p.a. during 2002-2004, reaching a record high of 95.9% in 2004. Investment inflows into the Armenian distribution system and improved marketing arrangements are expected to enhance the energy efficiency of the system and payment collection.

***Balance between fuel and energy import and export:***

Total imports in 2004 amounted to 2.21 million t.c.e., exports – to 0.21 million t.c.e. Total imports include 1.33 BCM natural gas, and 0.532 million t oil products. Total exports include 0.76 billion kWh electricity (flows inclusive).

Self-sufficiency – 1.15 million t.c.e, or 36.5% of total primary energy consumption.

***Fuel mix:***

Natural gas – 64%;  
Firewood and wood waste – 17%.

***Pattern of electricity demand in 2004 (billion kWh):***

Industry and construction – 1.4;  
Transport and telecommunications – 0.11;  
Agriculture – 0.26;

Residential and public services sector – 1.64, including Households – 1.44  
 Services – 0.73  
 Others – 0.32  
 Power grid losses – 0.8.

**Heat balance in 2004 (million Gcal):**

Consumption within the Republic – 0.327

**Generation** of electricity in 2004 – 6.03 billion kWh (consumption 4.0 billion kWh), heat – 0.327 million Gcal.

Installed capacity of all power plants – 3.203 million kW, including: thermo – 1.756 million kW; hydro – 1.039 million kW; nuclear – 0.408 million kW.

**Efficiency** (specific fuel consumption):

Electricity – 380.25 g.c.e./kWh

Heat from power plants – 170 kg c.e./Gcal

**Renewables** – electricity from hydro – 2.01 billion kWh.

**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 dependency on energy imports	3
Reduce total final consumption / GDP	4
Diversification of fuels	1
Increase utilisation of indigenous primary energy sources	2
Reduction of CO <sub>2</sub>	5

**2.2. Energy Policy Implementation**

Organisations responsible for policy implementation:

- *Energy sector development (consumption, generation and market trends)*
  - Energy Ministry
  - Public Services Regulation Commission

- *Ministry (ies) responsible for energy related aspects, including energy pricing policies.*
  - Energy Ministry
  - Public Services Regulation Commission.
- *Institutions directly involved in policy preparation/formulation*
  - Energy Ministry
  - Ministry of Finance and Economy
  - Environmental Protection Ministry
  - Public Services Regulation Commission
  - Energy Strategy Centre
  - Energy Research Institute
  - Armenian State University of Technology.
- *Institutions/agencies involved in policy implementation*
  - Energy Ministry
  - Ministry of Finance and Economy
  - Environmental Protection Ministry
  - Public Services Regulation Commission
  - Energy Strategy Centre
  - Energy Research Institute
  - Armenian State University of Technology
  - ArmRosgazprom CJSC
  - Armenian Power Grids CJSC
  - Power Grid Operator CJSC
  - Settlement Centre CJSC
  - High Voltage Power Grids CJSC
  - Generating companies.

## **2.3. Energy Prices**

### **2.2.1. Energy pricing policy**

#### *Grade of (domestic) regulation and competition on energy markets*

Diesel fuel and gasoline imports are governed by the rules contained in a dedicated law on imputed payments due from legal entities and individuals. Irrespective of imputed payers' economic results and the customs value of fuels, the following imputed tax rates are used: US \$65/t for diesel fuel (in drams or in hard currency), and US \$222/t for gasoline.

Retail trade is conducted in a competitive market environment. There are numerous private filling stations offering fuels, lubricants and services. Oil product prices were liberalised in 1993.

Benchmarks for regulated power and heat rates and natural gas prices, as well as prices for services in these areas are set forth in the Energy Law and include the following:

- (a) reimbursement of reasonable operations and maintenance costs, as well as fixed and intangible asset depreciation as may be necessary for the licensed operations in accordance with the license terms and conditions;
- (b) securing a reasonable rate of return;

- (c) inclusion of reasonable debt service costs;
- (d) rate differentiation per consumption volumes, nominated capacity, season, time, connection arrangements and service type;
- (e) inclusion of the necessary and reasonable social costs;
- (f) incorporation of reasonable nature protection costs;
- (g) incorporation of mothballing and maintenance costs provided for in the Energy Sector Development Programme approved by the Government;
- (h) securing the cost of spent nuclear fuel storage and required charges for nuclear power plant decommissioning;
- (i) provisions for reasonable process and commercial losses; and
- (j) provisions for other reasonable costs envisaged in the law.

*Price setting/regulatory mechanisms, institutions responsible*

The Armenian **Energy Regulatory Commission** was established by virtue of the April 3, 1997 Decree of the President and ratified by the Energy Law. Given that the Commission's authorities were expanded and the Commission was also charged with regulation of potable and irrigation water supply, a new law was adopted on the public services regulator in 2004 and the name of the Commission was changed to the "**Public Services Regulatory Commission**".

The Commission is modelled on the US Public Utilities Commissions and includes five (5) members who are nominated by the Prime Minister and approved by a Decree of the Armenian President.

1. The Commission determines the procedure for the establishment and revision of tariffs, as all as requisite document formats (application package) to be submitted by the licensee in this connection.
2. Established tariffs take effect 30 days after the adoption of the relevant resolution. The term of a tariff cannot be shorter than six months unless the licensee breaks the license terms and conditions, in which case the Commission may change the licensee tariff, with the changed tariff to remain in effect until the licensee rectifies the breach.
3. The Commission may set a long-term tariff for the licensee's operations.
4. A tariff may be set in the form a specific numerical value or a tariff-setting formula that is a function of specific values.
5. An established tariff may be revised on the initiative of both the licensee and the Commission. The Commission reviews (re-approves or revises) the tariff and passes a resolution within 90 days after receipt of a revision application package from the licensee.
6. On its own initiative, the Commission may revise an effective tariff and set a new one in accordance with its approved procedure based on the licensee's business results, investment programme implementation, and consumer service quality requirements.

7. A license holder may sell electricity, heat and natural gas or perform licensed services at a lower rate than that established by the Commission provided, however, that the licensed activity is not and will not be affected and/or the intent is not to seek a monopoly status on the market and if such a reduction is made for the account of the licensee's profit. In the case of such tariff reductions, the Commission approves new tariffs overlooking any potential losses incurred by the licensee.

The Commission adopted a number of regulations seeking to create an attractive investment climate for the advancement of new renewable sources of energy. The most significant of these are listed below:

- Regulation No. 1 of January 13, 2003, *Approval of the energy rate setting and revision procedure in the Republic of Armenia*, enabling the use of accelerated depreciation (up to 16.67% p.a.) for small hydro constructed with debt financing;
- Regulation No. 52H of September 2, 2003, *Setting the maximum price for electricity generated from biomass*, establishing the maximum price for the electricity generated based on the "urban solid waste – biogas – electricity" process at US \$0,07/kWh net of VAT and the maximum rate of return at 20% (after tax) during the first seven years of operations;
- Regulation No. 20H of February 9, 2004, *Setting the price for electricity supplied from small hydro*, establishing a fixed price for electricity supplied from small natural water flow-driven hydro power plants at US \$0.045/kWh net of VAT for the period until April 1, 2016.
- Regulation No. 21H of February 9, 2004, *Setting the price for electricity supplied by wind power plants*, establishing a fixed price at US \$0.07/kWh net of VAT for the period until April 1, 2016.

#### *Energy pricing and consumer behaviour*

Pursuant to the provisions of the Energy Law, the Commission has adopted a regulation on the energy tariff setting and revision procedure.

#### **Pricing**

Prices for electricity supplied to end-users are set by the Commission in the following manner:

Users are classified by voltage:

1. For users of voltage 35 kV and above – 16 drams/kWh (US \$1  $\cong$  533 Armenian drams, 2004) and a reduced night rate of 12 drams/kWh effective from 11 p.m. to 7 a.m. of the next following day;
2. For direct feed users of 6(10) kV voltage – 20 drams/kWh and a reduced night rate of 12 drams/kWh;
3. For indirect feed users of 6(10) kV voltage – 25 drams/kWh and a reduced night rate of 12 drams/kWh;

4. For users of 0.38 kV voltage (households and others) – 25 drams/kWh and a reduced night rate of 15 drams/kWh;

The Commission sets prices for heat supplied from district heating sources. For example, the price for heat supplied from the Yerevan TPP to industrial users in the form of 13-25 atm steam equals 6000 drams for 1 GJ, and in the form of hot water supplied to households is 2826 drams/GJ or 1605 drams per 1 m<sup>2</sup> heated per heating season. The price for hot water supplied to households from the Razdan TPP equals 1714 drams/GJ.

Natural gas prices have remained virtually stable since 1999, equalling US \$102 per 1000 m<sup>3</sup> for households and US \$79 per 1000 m<sup>3</sup> for all other users.

The final electricity price incorporates the following: generation, transmission, distribution, marketing, system services (dispatch and the settlement centre), and tax. Natural gas and heat prices follow a similar pattern.

Rates and prices are uniform within the entire country.

End-user prices are published in the Bulletin of Departmental Regulatory Acts of the Republic of Armenia.

There are no market-driven prices for electricity.

#### *Subsidies and cross-subsidies*

Government subsidies in the Armenian energy sector are nonexistent and cross-subsidies have been minimized.

### **2.2.2. Price levels**

In 2004 electricity prices for the above voltages changed from US \$0.03/kWh (night rate: US \$0.022/kWh) to US \$0.047/kWh.

Similarly, heat rates changed from US \$13.3/Gcal to US \$20/Gcal.

Natural gas prices equal US \$102/1000 m<sup>3</sup> for households and US \$79/1000 m<sup>3</sup> for all other consumers.

In 2004, heat prices depended on the source of heat and varied from US \$3.2/GJ to US \$5.3/GJ, or US \$3.0 per 1m<sup>3</sup> of living space during the heating season.

### **2.2.3. Environmental Levies and Taxes**

There are no environmental taxes or levies.

There is a pollution fee depending on the pollutant types and emission volumes.

## 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 <sub>2</sub> emissions?		X	

### 3. END-USE SECTORS

The industrial sector consumes 40% of all primary energy, mainly in the energy, mining, chemical and construction materials industries.

The second is the transport sector consuming 24% of all primary energy given its annual consumption increase, the degree of its adverse environmental impacts and the quantities of the emitted hazardous substance and GHG emissions.

The residential sector is accounting for 15% of the total energy consumption.

Agriculture is accounting for 4% of total energy consumption.

## **4. ENERGY EFFICIENCY POLICIES**

### **4.1. Energy Efficiency Policy**

The pursuit of an aggressive energy efficiency policy in Armenia began in 1995 following the adoption of the Energy Policy Programme. At that time, the priorities included enhancing the energy system reliability and nuclear power plant safety. However, energy efficiency matters were tackled spontaneously in the absence of any purposive policy.

The intent of the Energy Saving and Renewables Law was to formulate and approve the government policy framework for energy saving activities and development of renewables with a view to:

- strengthen the economic and energy independence of the Republic of Armenia;
- enhance the reliability of the Armenian energy system;
- create new manufactures and services to facilitate energy saving and promote renewables; and
- reduce man-made impacts on the environment and human health.

The Energy Saving and Renewables Law of the Republic of Armenia adopted in 2004 set forth the key government policy areas of energy saving regulation that included the following:

- development, adoption and implementation of government (national, target-oriented) energy-saving programmes;
- organization and coordination of the work performed under government programmes designed to ensure efficient energy use;
- compulsory incorporation of energy-saving requirements into government programmes relating to the development of the economic sectors in Armenia;
- development and introduction of energy-saving and energy efficiency standards;
- introduction of voluntary power unit certification;
- maintenance of energy resource accounting and statistics;
- financial support to energy efficiency projects and programmes;
- training, support of technical change, awareness and promotion with a view to enhance energy efficiency; and
- promotion of international cooperation in energy efficiency project implementation.

*The government energy efficiency policy is based on voluntary participation of the parties involved. Government authorities are not charged with any controlling or supervisory functions. Economic incentives are only used.*

## **4.2. Legal Framework**

The Energy Saving and Renewables Law was adopted by the National Assembly of the Republic of Armenia on November 9, 2004.

Energy saving measures are also a top priority under the Energy Law.

## **4.3. Energy Efficiency Targets**

A decree that has now been submitted to the Prime Minister for approval provides that a National Energy Saving Programme which is indispensable for Armenia will be developed within two years to specify and, *inter alia*, quantify the key energy saving targets for both the energy industry and other economic sectors.

## **4.4. Energy Efficiency Priorities**

Final energy efficiency priorities can be determined after the National Energy Saving Programme is developed. However, a preliminary review indicates the following:

The first priority in the area of energy efficiency is the industrial sector which consumes 40% of all primary energy, with its major target constituents including the energy, mining, chemical and construction materials industries. Energy saving actions can be implemented on a fast track because there are economic incentives and highly qualified personnel. A certain constraint may be a lack of necessary funding and materials.

The second priority area is the transport sector consuming 24% of all primary energy given its annual consumption increase, the degree of its adverse environmental impacts and the quantities of the emitted hazardous substance and GHG emissions. Government assistance to the conversion of motor vehicles to alternative fuels (natural gas, LNG, biogas), a process that is spontaneously underway in Armenia, is seen as an important priority.

The third priority area includes the residential sector accounting for 15% of the total energy consumption. Despite the considerable expected potential in this sector, the implementation of energy saving measures is constrained by its large investment requirements and the socially disadvantaged status of the population.

Agriculture is seen as a fourth priority, accounting for 4% of total energy consumption. Implementation is constrained by the lack of sufficient funding in rural areas and the absence of highly qualified personnel in the farm produce processing sector.

#### **4.5. Energy Efficiency Financing**

At present, no funds are specifically earmarked for energy efficiency because a National Energy Saving Programme is yet to be developed and its targets quantified.

Nonetheless, in cooperation with the World Bank, the European Bank for Reconstruction and Development, the UN Global Environment Facility, the US Agency for International Development and, potentially, the charitable Kafesjan Foundation, the Government of Armenia has established an Energy Saving and Renewables Fund, with its Board of Trustees to be headed by the Prime Minister. The Fund will be replenished through a reasonable loan interest and is eventually expected to grow so that the promotion of energy saving and renewables will be financed from the Fund in addition to the national budget.

#### **4.6. International Co-operation**

In cooperation with international organizations, the following energy efficiency and renewable energy projects have been implemented in the Armenian energy sector:

**1. RMA (USA): Accelerated Programme to Support the Armenian Energy Sector (0.3/93-06/94).**

Training of local personnel to conduct energy audits of industrial enterprises.

**2. R&A (USA): Heat Insulation Programme (04/94-02/95).**

Heat insulation of residential buildings, hospitals, schools and public buildings.

**3. RMA (USA): Atmospheric Impact Protection Programme for Armenia (09/95-09/96).**

Heat insulation of residential buildings, hospitals, schools and public buildings.

**4. R&A (USA): Energy-Saving in Industry (08/94-03/97).**

A study of the energy-saving potential of industrial enterprises in Armenia.

**5. RMA, R&A (USA): Institutionalisation and Privatisation of Atmospheric Impact Protection Activities (12/96-12/97).**

Heat insulation of residential buildings, hospitals, schools and public buildings.

**6. TACIS, BCEOM (France): Support to the National Energy Saving Strategy (01/93-04/94).**

Energy saving potential assessment in the industry and the energy sector, and in district heating.

7. **TACIS, BCEOM (France): National Energy Saving Strategy Implementation** (12/94-10/96).  
Energy saving potential assessment of the industry and the energy sector, and in district heating. Development of the energy balance of the Republic of Armenia.
8. **TACIS, DECON-EPU-NTU (Germany, Greece, Austria): Creation of an Energy Strategy Centre for Energy Sector Projects** (08/96-12/98).  
Development of an investment package, including energy saving projects. Development of business plans for selected energy efficiency projects.
9. **TACIS, WS/Atkins (UK): Formation of an Energy Centre in Armenia** (04/94-02/96).  
Energy audits of enterprises, energy saving potential assessment of selected industries and district heating systems.
10. **TACIS, WS/Atkins (UK): Formation and Management of an Energy Centre** (08/96-02/98).  
Training; pilot project implementation; training in business planning for energy saving projects, and information campaigns.
11. **TACIS, G&Fint (Italy): Strengthening the Role of the Energy Centre** (11/98-07/99).  
Armenian energy balance in 1996-1998. Development of a business plan for rehabilitation of district heating systems in Yerevan.
12. **E-connection (Netherlands): ArmNedWind-1** (05/99-02/01).  
Wind power potential monitoring in Armenia. Development of a feasibility study for wind power units. Development of a wind energy development programme for Armenia.
13. **Advanced Engineers Association International /EREP/** (May 2001 up to date).  
An energy efficiency and renewables programme.
14. **Alliance to Save Energy / Municipal Network for Energy Efficiency (MUNEE)**  
In cooperation with the Alliance to Save Energy, USAID provided technical support to a World Bank urban heat supply programme.
15. **PA Consulting Group/ Non - Heat Energy Efficiency and Renewable Energy Pilot Projects/** (Since 2004).
16. **UNDP/Armenia - Improving the Energy Efficiency in Municipal Heating and Hot Water Supply** (Since 2005).

Urban heat supply and improvement of hot water supply energy efficiency.

**17. Removing Barriers to Energy Efficiency in Municipal Heat and Hot Water Supply/GEF/UNDP/Project Development Facility G/1999-2002/**

Project development stage.

**18. OPET-Armenia (Organizations for Promotion of Energy Technologies) (1999-2004).**

The Clean Solid Fuels Programme. The OPET Branch worked in Armenia as part of the Energy Strategy Centre.

#### **4.7. Energy Efficiency Institutions**

By its Decree No. 55-H of January 25, 2005, the Armenian Government designated the Energy Ministry as the government authority in charge of energy efficiency policy implementation.

Other government bodies of the Republic of Armenia (Trade and Economic Development Ministry, Environmental Protection Ministry, Urban Development Ministry, Science and Education Ministry, etc.) are involved in the state regulation of energy saving within the authorities vested in them.

A decree of the Prime Minister is currently being drafted to include an action plan containing instructions to relevant government authorities to implement the provisions of the Energy Saving and Renewables Law. The decree would provide for the development of a National Energy Saving Programme that is indispensable for Armenia.

#### **4.8. Energy Efficiency Monitoring**

In the absence of an approved energy efficiency programme, no energy efficiency monitoring is underway.

### Summary Table III: Energy Efficiency Policies

Please indicate in the table (with **X**) which status is applicable regarding the following issues concerning energy efficiency policies.

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

## 5. ENERGY EFFICIENCY INSTRUMENTS AND MEASURES

*This section aims at giving an overview of energy efficiency instruments and measures. The questions/tables are directly related to the following Protocol requirement: “Develop, implement and update programmes (art. 8.1). Programmes may include among others such activities as: economic and environmental assessment of actions taken, definition of standards, development of databases, innovation approaches to financing energy efficiency, support of cogeneration”.*

*The types of instruments can include:*

- **Normative/legislative instruments** (laws, permits, labelling, standards, inspections).
- **Financial instruments** (subsidies, loans, fiscal measures, third party financing);
- **Information/awareness** (brochures, handbooks, consultations, advice centres etc);
- **Education/training/advisory instruments** (consultancy, on the job training, audits);
- **Voluntary agreements** (declarations of intent, sector agreements, certification);
- **Research and development** (basic research if clearly oriented to energy efficiency in a specific sector, applied research, experimental development);

### 5.1 Cross-sectoral Instruments and Measures

*Please present information about the policy instruments and measures for increased energy efficiency and renewable energy use with relevance for several sectors (e.g. energy efficiency/conservation law, energy agencies, energy tax, energy certificates for buildings from different sectors, general information campaigns, general education programmes, etc.)*

*Please complete table 5.1. Indicate in column 2 which sectors are influenced by the respective instrument or measure.*

**Table 5.1. Cross-sectoral instruments and measures**

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

\* Please, provide budget in Euro or USD and specify the currency used.

## 5.2 Instruments and Measures in the Residential Sector

*Please present information about the policy instruments and measures for increased energy efficiency and renewable energy use in the residential sector.*

*Please complete table 5.2.*

**Table 5.2. Instruments and measures in the residential sector**

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

\* Please, provide budget in Euro or USD and specify the currency used.

## 5.3 Instruments and Measures in the Industrial Sector

*Please present information about the policy instruments and measures for increased energy efficiency and renewable energy use in the industrial sector.*

*Please complete table 5.3.*

**Table 5.3. Instruments and measures in the industrial sector**

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

\* Please, provide budget in Euro or USD and specify the currency used.

## 5.4 Instruments and Measures in the Services Sector

*Please present information about the policy instruments and measures for increased energy efficiency and renewable energy use in the services sector.*

*Please complete table 5.4.*

**Table 5.4. Instruments and measures in the services sector**

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

\* Please, provide budget in Euro or USD and specify the currency used.

## 5.5 Instruments and Measures in the Transport Sector

*Please present information about the policy instruments and measures for increased energy efficiency and renewable energy use in the transport sector.  
Please complete table 5.5.*

**Table 5.5. Instruments and measures in the transport sector**

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

\* Please, provide budget in Euro or USD and specify the currency used.

### Summary Table IV: Instruments and Measures

*Please indicate in the table (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						
Industry						
Services						
Transport						

## 6. ACTORS IN ENERGY EFFICIENCY

*Policy instruments aim to achieve improved energy efficiency. These instruments are focused on various target groups, groups of end-users or intermediary organisations. Either of these groups has its specific interests, ambitions, abilities and role. The more policy instruments are linked to these interests and abilities the more successful they will be.*

*Please, provide description of the different actors (public and private institutions, NGOs, manufacturer or professional associations, etc.) active in the energy efficiency field in the different sectors in your country. Summarise the description in Tables 6.1 to 6.8 below.*

**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

**Table 6.2. End users in the residential sector**

RESIDENTIAL SECTOR, END CONSUMERS	INTEREST	ATTITUDE	ABILITY

**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

**Table 6.4. End users in the industrial sector**

INDUSTRIAL SECTOR, END CONSUMERS	INTEREST	ATTITUDE	ABILITY

**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

**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

Of the total renewables potential, only hydro is used in Armenia at the present time. On the average, about 25% and, in 2003-2004 up to 36% of electricity was generated by hydro power stations.

By an expert estimate, complete harnessing of renewables would help to meet more than a half of the present-day power needs and a considerable part of the heat requirements, contributing to the energy security of Armenia, protecting it from energy crises and promoting its economic development and political stability. In addition, a greater role of renewables in the energy balance would enable displacement of the corresponding amount of organic fuels, contributing to both GHG emission reductions and emission trading based on the Kyoto Protocol mechanisms.

As presently estimated, **hydro** accounts for the main part of renewables. The economic hydro potential stands at 3.5 billion kWh. Given that 1.5-1.6 billion kWh is already in use, the construction of new hydro power plants would help to add up to 2 billion kWh.

The new government policy has already resulted in the privatization of 16 small hydro power plants with a total capacity of 32 MW and an aggregate design output of 100 million kWh. Over the past six years, 18 new hydro power plants have been constructed and six others are still under construction. The hydro power development plans envision the harnessing of the entire economic hydro potential in Armenia. In doing so, the provision is made for the construction of large, medium and a number of small hydro power plants as part of Armenia's Small Hydro Power Plants Scheme envisaging the construction of 320 small HPP's with an aggregate capacity of 270 MW and a total output of 700 million kWh.

In the next 15-20 years, three large HPP's with a total capacity of about 275 MW and many small hydro projects are planned for construction.

Armenia's **wind potential** is rated rather high. Background meteorological information covering many years and new research estimate the hypothetical potential at 10.7 TWh and the technical potential with 10-percent capacity utilisation at about 1.1 TWh. For the purpose of updating the wind potential, on the initiative of the Armenian Energy Ministry and in cooperation with the USAID, the US National Renewable Energy Laboratory has developed an atlas of Armenian wind power resources which indicates that the national wind potential is sufficient for the construction of wind power plants with a total capacity of 450-1000 MW.

Based on the available information, the construction of a wind power plant got underway at the Pushkin Pass, with a capacity of 2.6 MW and a potential expansion to 20 MW; there are plans to construct wind power plants (50 MW) in the region of Zod in the next 5-10 years; monitoring work is expanding.

Armenia is among high **solar** potential countries.

The average annual radiant flux per 1 m<sup>2</sup> of flat surface stands at 1720 kWh/m<sup>2</sup> (the European average is about 1000 kWh/m<sup>2</sup>). The share of direct radiation is also considerable at 65-70%, which is very notable from the prospective of implementation

of focusing concentrators. The development of the solar potential in Armenia is chiefly following two paths: the manufacture and installation of photovoltaic converters; and the manufacture and installation of flat-plate solar collectors for water heating.

The first option has not yet made sufficient headway because of the high cost of photovoltaic converters. However, converters with a unit capacity of up to 5 kW are individually custom-made.

The second alternative – the use of solar heat collectors – is quite successful. Over 400 m<sup>2</sup> of solar collectors have already been made and installed.

An improving economic situation and the large solar potential facilitate a steady increase in the number of solar collectors used, giving rise to forecasts that 3-5% of the population will have such collectors in the next 15-20 years.

Armenia has a considerable **geothermal** potential but its utilisation is now largely limited to resort and curative uses because low-temperature (below 100°C) geothermal resources have mainly been discovered thus far. However, as a result of recent studies, there are valid reasons to believe that there are geothermal sources in southern Armenia with a water temperature of about 215°C occurring at a depth of 1600-1700 m.

The use of **biomass** for biogas production is in progress and expanding. In 2002-2003, two biogas units were constructed: one with a 50 m<sup>3</sup> methane tank with a potential expansion to 3000 m<sup>3</sup>, and the other with a 25 m<sup>3</sup> methane tank. The aggregate gas volumes that could be obtained from large livestock farms and *Aeration* Company are presently estimated at more than 100000 m<sup>3</sup> per day.

## **7.2 National Policy for Renewables Deployment – Policy Instruments**

Armenia has created the necessary legal framework for successful deployment of renewables. The State Energy Policy section of the Energy Law adopted in 2001 says that the maximum use of the national energy resources is a top priority of the energy sector development. The Law guarantees domestic purchases of all RES-generated electricity. The Energy Saving and Renewables Law adopted at the end of 2004 provides for additional favourable conditions for the deployment of renewables. The Public Services Regulatory Commission pursues a tariff-setting policy that also helps to attract investments in renewable energy. The Commission has set a rate at US \$0.045/kWh (net of VAT) for small natural flow-driven hydro and at US \$0.07/kWh (net of VAT) for wind farms. The rate for solid waste biogas electricity equals US \$0.07/kWh (net of VAT).

## **7.3 Renewables Policy Implementation**

The renewable energy policy is made, implemented and coordinated by the Armenian Energy Ministry. The tariff-setting policy encouraging RES development is the responsibility of the Public Services Regulatory Commission.

There are a number of government and private entities in the country that are interested in the design and construction of energy facilities generating power from RES.

## **8. ENERGY AND ENVIRONMENT**

### **8.1. General Trends and Objectives**

Priorities and objectives relating to environmental protection and the rational uses of natural resources are contained in the following laws of the Republic of Armenia: the Ambient Air Law of November 1, 1994; Environmental Impact Assessment Law of November 20, 1994; Environmental Fee Rates Law of April 29, 2000; Environmental Inspectorate Law of April 11, 2005; and a number of legislative and regulatory acts.

Armenia acceded to the following international conventions on environmental protection:

- UN Framework Convention on Climate Change (UNFCCC) (came into force on March 21 1994) – ratified by Armenia;
- Kyoto Protocol (came into force on February 16, 2005) – ratified by Armenia;
- Convention on Long-Range Transboundary Air Pollution (came into force in 1983) – ratified by Armenia;
- Montreal Protocol on Ozone Depleting Substances (entered into force on January 1, 1989) – ratified by Armenia;
- Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal (came into force on May 5, 1992) – ratified by Armenia; and
- Convention on the Environmental Impact Assessment in a Transboundary Context (Espo, 1991) – ratified by Armenia.

Relation to the environmental policy:

- Total hazardous emissions are on the decline due to a reduced energy consumption;
- Sulphur oxide emissions are virtually nonexistent due to replacement of fuel oil with natural gas while reduced CO<sub>2</sub> emissions are caused by the general decrease in power generation and, consequently, fuel combustion;
- By its Resolutions No. 799 of December 31, 1999, No. 902 of December 31, 2000, and No. 913 of September 29, 2001, the Armenian Government gradually prohibited the import and production of leaded gasoline;
- By its Resolution No. 220N dated March 3, 2005, the Armenian Government prohibited the import of motor vehicles without catalytic converters effective from 2006;
- Decision No. 40 of the Armenian Government, dated October 11, 2004, approved the concept of reducing hazardous emissions from motor vehicles. An action programme based on the approved concept has been developed and submitted to the Government for approval.

Based on the goal to secure a safe environment, the provision is made for attaining the following key objectives:

- improve existing processes and introduce state-of-the-art technologies to reduce atmospheric emissions and achieve the prescribed emission allowances;
- advance and upgrade the existing atmospheric monitoring system;
- continue to improve the regulatory and legislative framework for ambient air protection;
- improve the economic controls over environmental actions in the Republic with a view to introduce automated emission monitoring systems and relevant environmental equipment in the industry and energy sector;
- facilitate motor vehicle conversion to alternative motor fuels (natural gas, LNG, biofuel);
- contribute to public transport emission reductions by enhancing transportation efficiency, optimizing the traffic and developing electric transport;
- expand and deepen international cooperation.

Gross energy consumption in 2002 equalled 2.5 million t.c.e. versus 11.23 million t.c.e in 1990. The main reasons for such a rapid decrease in the energy consumption in Armenia include a decline in industrial output, structural changes in economic sectors and the natural wish of business entities to save energy due to more orderly spending control and accounting and higher market prices. With all that, there was a significant change in the energy consumption pattern: natural gas that accounted for 46% of the gross energy consumption in 1990 grew to 64% in 2004 while the share of fuel oil dropped from 32% to almost 0% and that of firewood/wood waste went up from 2.6% to 17-19%.<sup>1</sup>

As a result of such changes in the use of fuels and substitution of environmentally cleaner natural gas for fuel oil, greenhouse gas (GHG) emissions in the Republic (as CO<sub>2</sub> equivalent) decreased from 21.4 million tonnes to 3.9 million tonnes in 2000, i.e. by 17.5 million tonnes. The energy sector accounted for 9.7 million tonnes of this reduction.

The main sources of methane emissions include the energy sector (gas supply), agriculture and solid household waste landfills. Methane emissions in agriculture come from livestock farming.

Solid household waste landfills are usually concentrated near large cities and urban human settlements. Since 2001, in cooperation with the Armenian Government and Yerevan Mayor's Office, Shimadzu Corporation has been involved in the development of feasibility studies for several Clean Development Mechanism (CDM) projects. One of them relates to the collection of landfill gas and power generation at the Nubarashen

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<sup>1</sup> According to an expert estimate in *Armenia: a study of climate change, 2003*.

solid domestic waste disposal site in Yerevan, firing the landfill methane in a gas-fired generator. The project has now been validated by the national Operational Entity and is undergoing an approval procedure in the UNFCCC CDM Executive Board.

Ninety percent of emissions of nitrous oxide, one of the most active greenhouse gases, comes from agriculture (land farming) and largely relates to the use of mineral and organic fertilizers.

Given that Armenia's economic development has not been accompanied by large increase in consumption of fuels and energy since 1995, greenhouse gas emissions in 2004 may be estimated at 3.9-4.7 million tonnes of CO<sub>2</sub>.

As a developing country not listed in Annex I to the United Nations Framework Convention on Climate Change, Armenia is under no obligation to reduce GHG emissions. However, it could assume voluntary obligations to cut them down with the assistance from developed countries under the existing mechanisms designed to attain the goal proclaimed in the Convention. A preliminary review of GHG emission behaviour, the anticipated results of energy saving actions to be implemented after a relevant National Programme is adopted, and changes in the fuel consumption pattern have indicated that the Republic of Armenia has quite a large GHG emission reduction potential.

In accordance with the first Armenian National Communication under the UN Framework Convention of Climate Change:

- Energy sources are responsible for the majority of GHG emissions. They account for 97% of CO<sub>2</sub> emissions, 53% of CH<sub>4</sub> emissions (fuel leaks) and 43% of N<sub>2</sub>O emissions. In the nation-wide GHG emissions in the CO<sub>2</sub> equivalent, about 93% comes from the energy sector.
- The majority of CO<sub>2</sub> emissions are caused by fuel combustion.
- In 1990, the majority of CO<sub>2</sub> emissions from fuel combustion came from electricity generation and conversion (53%), the residential sector (18%) and transport (17%). By 2000, the CO<sub>2</sub> emission ratio changed as follows: electricity generation and conversion (43%), the residential sector (27.5%) and transport (19%).

## **8.2. Environmental Policy Implementation**

The authority responsible for environmental policy implementation in the Republic of Armenia is the Environmental Protection Ministry.

There are regional nature protection departments in all regions ("marzes") and a municipal nature protection department in Yerevan, as well as local subdivisions of the State Nature Protection Inspectorate.

In addition to the above entities, environmental matters are dealt with by the Emergencies Department, Health Ministry, National Statistical Service, and Armenian National Academy of Sciences in their respective areas of responsibility.

## **9. ASSESSMENT AND FUTURE PLANS**

### **9.1. Successful Instruments**

At the present time, energy saving activities in the Armenian economy are implemented by business entities on their own and follow the competition rules of a market-driven economy. The Armenian Government should come up with efficient economic incentives in accordance with the Energy Saving and Renewables Law of the Republic of Armenia to facilitate the acceleration and deepening of such processes.

### **9.2. Barriers**

The main barriers are as follows:

- Absence of adequate government funding;
- Disadvantaged social status of the majority of the population lacking the necessary initial investment resources;
- Absence of clear economic incentives to energy efficiency improvements;
- The population and businessmen lack the necessary and adequate knowledge and skills;
- Absence of requisite legislative and regulatory frameworks.

### **9.3. Programme and Strategy Improvements**

Potential ways to implement the National Energy Saving Programme which is under development now include the following:

- according priority and providing economic incentives to energy efficiency activities;
- raising public awareness and educating young people;
- improving energy efficiency personnel training;
- expanding international experience exchanges relating to the use of soft loans and broader CDM applications;
- expanding the legal framework to intensify energy efficiency activities.

### **9.4. Recommendations**

Recommendations may be issued in the process of the National Energy Saving Programme development and implementation.

## **10. CONSULTED SOURCES**

- 1) Energy Balances of the non-OECD Countries, 1995-2002; IEA, 2005
- 2) Energy Law of the Republic of Armenia, 2001
- 3) Energy Saving and Renewables Law of the Republic of Armenia, 2004
- 4) Public Services Regulator Law of the Republic of Armenia, 2004
- 5) Republic of Armenia Government Decree

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

**Armenia**

**REGULAR REVIEW 2005**

**Part II:**

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

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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 CO<sub>2</sub> emissions. Please complete all these tables as much as possible.*

### *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**

(billion US\$95)

	1992	1995	1999	2000	2001	2002
GDP	1.429	1.468	1.781	1.888	2.068	2.334
GDP(PPP)	5.365	5.513	6.686	7.087	7.764	8.763

Sources: IEA Statistics, Electronic version 2004

**Table b.2. Number of inhabitants**

(millions)

	1992	1995	1999	2000	2001	2002
Population	3.492	3.324	3.144	3.112	3.087	3.068

Sources: IEA Statistics, Electronic version 2004

## c. General Energy Data

**Table c.1.**

(Mtoe)

Indicators	1992	1995	1999	2000	2001	2002
Total Primary Energy Production	0.263	0.245	0.646	0.632	0.602	0.738
Net imports	4.036	1.425	1.199	1.440	1.462	1.199
Total Primary Energy Supply (TPES)	4.298	1.671	1.845	2.072	2.064	1.938
Total Final Consumption (TFC)	3.087	1.173	0.969	1.164	1.177	1.163
TFC/GDP (toe/thous.US\$)	2.160	0.789	0.544	0.617	0.569	0.498
Total Electricity Consumption*	0.536	0.262	0.313	0.309	0.299	0.294
Electricity produced from RES*		0.166	0.172	0.108	0.083	0.143
Heat produced from RES**						

Sources: IEA Statistics, Electronic version 2004; Ministry of Energy of the Republic of Armenia

\* 1 Mtoe = 11.63 TWh

\*\* 1 Mtoe = 4.1868x10<sup>4</sup> TJ; 1 Mtoe = 10<sup>7</sup> Gcal

## 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
Residential	0.318	0.084	0.170	0.160	0.145	0.142
Industry	0.728	0.314	0.477	0.398	0.428	0.409
Services	0.022	0.065	0.019	0.020	0.020	0.025
Transport	0.829	0.091	0.058	0.276	0.271	0.272
Agriculture	0.065	0.004	0.056	0.060	0.054	0.040
Others*	1.125	0.615	0.189	0.250	0.258	0.275
Total (TFC)	3.087	1.173	0.969	1.164	1.177	1.163

(Mtoe)

Sources: IEA Statistics, Electronic version 2004

\* 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
Total Final Consumption	0.318	0.084	0.170	0.160	0.145	0.142
a. Electricity	0.208	0.055	0.139	0.134	0.127	0.129
b. Heat	0.040	0.023	0.025	0.026	0.018	0.013
c. Oil products	0.007	0.004	0.005	-	-	-
d. Gas	-	0.003*	0.064*	0.073*	0.075*	0.081*
e. Coal	0.063	0.001	0.001	-	-	-
f. Combust. Renew. & Waste	-	-	-	-	-	-
g. Others	-	-	-	-	-	-
Floor Area ('000 m <sup>2</sup> )						
No. of dwellings ('000)						
Residential use per dwelling (toe/dwelling)						
Residential use per surface (toe/m <sup>2</sup> )						

(Mtoe)

Sources: IEA Statistics, Electronic version 2004

\* Ministry of Energy of the Republic of Armenia

**Table d.3: Final Consumption of the Industry Sector by Energy Source in 2002**

(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	-	-	-	-	-	-	-	327	-	327
Electricity	25	-	11	10	7	-	7	5	1	66
Heat	-	-	-	-	-	-	-	16	-	16
Combust. Renew.&Waste	-	-	-	-	-	-	-	-	-	-
Total	25	-	11	10	7	-	7	348	1	409
Value added per sector (1995 USDx10 <sup>6</sup> )										
Energy/value added (Mtoe/10 <sup>6</sup> USD)										

Sources: IEA Statistics, Electronic version 2004

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

Indicators services sector	(Mtoe)					
	1992	1995	1999	2000	2001	2002
Total Final Consumption	0.022	0.065	0.019	0.020	0.020	0.025
a. Electricity	0.022	0.065	0.019	0.020	0.020	0.025
b. Heat	-	-	-	-	-	-
c. Oil products	-	-	-	-	-	-
d. Gas	-	-	-	-	-	-
e. Coal	-	-	-	-	-	-
f. Combust. Renew. & Waste	-	-	-	-	-	-
g. Others	-	-	-	-	-	-
No. of employees (mil.)						
Floor area ('000 m <sup>2</sup> )						
Value added (10 <sup>6</sup> USD)						
Energy/value added (Mtoe/10 <sup>6</sup> USD)						
toe/Employee						
toe/m <sup>2</sup>						

Sources: IEA Statistics, Electronic version 2004

**Table d.5. Transport indicators (2002)**

Indicators transport sector	Freight	Travel	Total
Total Final Consumption (Mtoe)			0.272
10 <sup>9</sup> Tonne-km		-	
TFC/10 <sup>6</sup> tonne-km		-	
10 <sup>9</sup> Person-km	-		
TFC/person-km (TFC/10 <sup>6</sup> 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 <sup>7</sup> kcal GCV*)	Steam Coal (tonne)	Electricity (KWh)
Industry							
Households (Incl. ...% VAT)							
Electricity generation	-						-

\* Gross Calorific value

Sources:

## f. CO<sub>2</sub> Emissions

*Please complete the following table on CO<sub>2</sub> emissions. If available, please supply the data on emissions per sector as well.*

**Table f.1. CO<sub>2</sub> emissions from fuel combustion**

Indicators	1992	1995	1999	2000	2001	2002
Total CO <sub>2</sub> emissions (Mtonnes/year)	10.75	3.43	2.96	4.09	4.23	
Share electricity and heat production (%)						
Share residential sector (%)						
Share industrial sector (%)						
Share transport sector (%)						
Share other sectors (%)						
Total CO <sub>2</sub> /GDP (kg/USD '95)	3.83	1.19	0.85	1.10	1.04	
Total CO <sub>2</sub> /capita (tonnes/inhabitant)	2.92	0.91	0.78	1.08	1.11	
Total CO <sub>2</sub> / TFC (tonnes/toe)	3.48	2.92	3.05	3.51	3.59	

Sources: IEA Energy Statistics, 2004 Electronic Version