

# NATIONAL REPORT

On

Enhancing Synergies in CIS National Programmes on  
Energy Efficiency and Energy Saving for Greater Energy  
Security

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## List of Acronyms

|         |                                                        |
|---------|--------------------------------------------------------|
| AMD     | Armenian drams                                         |
| ArmSEFF | The Armenian Sustainable Energy Financing Facility     |
| ADB     | Asian Development Bank                                 |
| CIS     | Commonwealth of Independent States                     |
| CJSC    | Closed Joint Stock Company                             |
| EBRD    | European Bank for Reconstruction and Development       |
| EE      | Energy Efficiency                                      |
| ENA     | Electricity Networks of Armenia                        |
| ENP     | European Neighbouring Partnership                      |
| ES      | Energy Saving                                          |
| ESCOs   | Energy Service Companies                               |
| ETL     | Electricity transmission lines                         |
| EU      | European Union                                         |
| GIS     | Geographical Informative System                        |
| RE      | Renewable Energy                                       |
| R2E2    | Armenia Renewable Resources and Energy Efficiency Fund |
| GoA     | Government of Armenia                                  |
| GDP     | Gross Domestic Product                                 |
| GPOBA   | Global Partnership Output-based Aid                    |
| HPP     | Hydroelectric Power Plant                              |
| HVEN    | High Voltage Electricity Networks CJSC                 |
| IMF     | The International Monetary Fund                        |
| LLC     | Limited Liability Company                              |
| OWL     | Over head line                                         |
| RA      | Republic of Armenia                                    |
| RF      | Russian Federation                                     |
| SHPPs   | Small Hydro Power Plants                               |
| SPC     | Solar photovoltaic Converter                           |
| TPP     | Thermal Power Plant toe tons of oil equivalent         |
| USA     | United States of America                               |
| USSR    | Union of Soviet Socialistic Republics                  |
| USAID   | United States Agency for International Development     |
| UNDP    | United Nations development Programme                   |
| UNIDO   | United Nations Industrial Development Organization     |
| WB      | World Bank                                             |
| WTO     | World Trade Organization                               |

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## **Executive Summary**

The basic principle of Armenia's energy policy is to ensure sustainable energy development, guided by the trends of the economy, the prospects of increased regional cooperation and in the light of experience in the energy sector, as well as maximum use of energy efficient technologies both in the energy industry and other industries economy.

The Government of Armenia has approved the Energy Security Strategy of the country.

The strategy is based on the following fundamental principles:

1. Full utilization of renewable energy resources and energy efficiency;
2. Nuclear energy development;
3. Integration of Armenia into regional power markets and participation in regional projects;
4. Diversification of routes of delivery of types of primary energy resources.

Armenia is largely dependent on imported energy. The only domestically produced primary form of energy is electricity produced by hydroelectric power plants and one nuclear power plant which accounts for about 40% of total primary energy sources. In this context, Armenia's energy strategy involves both ensuring an uninterrupted supply of energy resources from abroad, and further development potential of their own renewable energy and energy-saving technologies.

This new source of energy—the energy efficiency is more beneficial than the other energy sources.

The low level of energy efficiency of the economy of Armenia was due to two factors.

1. Insufficient measures to promote energy efficiency.
2. The limited resources of their own population and enterprises.

In the field of information and education, there is enough low level of both business and the public about the scientific, technical, organizational, economic and other opportunities for energy conservation and renewable energy. In addition, there is a qualified personnel, as well as relatively low public concern issues of rational use of energy.

Increase understanding of the obstacles and challenges in the field of energy efficiency and knowledge of the best ways to address them, is the key to unlocking the potential of Armenia in the field of energy efficiency.

Hence, the sustainable development of Armenian economy and energy sector and its independence must be based on increasing energy efficiency in all energy consuming sectors and on the strategy and program of development of the renewable energy based on national interests and targeted towards mitigation and overcoming the problem of low energy efficiency of the national GDP and the scarcity of domestic fuel-energy resources.

## INTRODUCTION

The main purpose of the National Program on Energy Saving and Renewable Energy is to set targets for the energy saving and renewable energy development in Armenia and to determine the means for their realization.

Inclusion of energy efficient technologies and renewable energy in the fuel-energy mix will play a key role in increase the energy supply level of economy through the use of domestic fuel-energy resources and will ensuring an increased level of energy independence. It will alleviate the dependence of the country on foreign fuel sources and will establish a basis for transition from extensive quantitative economic development to more productive development and for making a policy based on national interest, through increasing energy independence of the country. Additionally, heavier reliance on energy efficiency and the utilization of renewable energy resources will result in emissions reduction and will contribute to solving environmental complications associated with the burning of fossil fuels.

The adoption of energy saving and renewable energy is accompanied by implementation of new production and management technologies. This experience will assist in sustainable development of Armenia into a knowledge-based economy. It is of national interest to Armenia in order to avoid being a source of raw materials and labor for developed countries. The development of energy saving and renewable energy, which contribute to energy independence of the country, also supports the process of integrating Armenia into the regional energy system.

The development of energy sector using only conventional fuel resources (natural gas, oil, etc.) is short-sighted. Traditional fossil fuels are finite in quantity and the exhaustion and/or the drastic price growth can be expected in the near future. In this regard, efficient consumption and use of renewable resources (solar, wind, etc.) is the only option for a developing economy. An increase in energy efficiency throughout all sectors of the economy leads to lower production costs, thus increasing the competitiveness of a product. There is a tendency to believe that increasing production and expanding economic growth directly leads to increased energy consumption. This National Program should outline clear methods for overcoming this belief. The policy priorities of the Armenian government are interrelated and include increased employment, economic growth, development of all sectors of economy, environmental protection, healthcare improvement, increased energy efficiency of GDP, etc.

Using sustainable development conditions, there is no contradiction between the economic growth and environmental protection. When government policy has a systematic character, with coordinated and harmonized standards, it will not hinder the adoption of energy efficient technologies in all levels of government.

The National Program on Energy Saving and Renewable Energy was developed based on the Agenda 21 of Global Program of Sustainable Development of 1992 United Nations General

Assembly Declaration on Environment and Development (Rio Convention or Earth Summit), ten years from that – the fundamentals for sustainable development proposed at Johannesburg Summit, other environmental conventions ratified by Armenia with the resulting responsibilities, the RA Government Poverty Reduction Strategy, the Energy Sector Development Strategy within the program of Economic Development of Armenia, as well as the state policy in the field of energy saving and renewable energy set by the Law on Energy and the Law on Energy Saving and Renewable Energy of Armenia. The National Program is directed to achieving the following goals: Support for the sustainable development of the Armenian economy.

- Through development of energy saving and renewable energy systems, decrease the dependence on foreign energy suppliers and avoid interruptions in the Armenian fuel supply.
- Alleviate the inefficient growth of the energy sector by securing intensive implementation of energy efficiency measures.
- Efficient consumption of fuel-energy resources and maximal employment of renewable energy resources, through application of targeted economic and legal mechanisms.
- Develop practical measures for achieving the targets set by this program. This includes the development and application of modern technologies and management practices.
- Maximal utilization of local/domestic advantages (renewable energy resources, professional human resources, the practice of energy system operation, current conditions of a region with scarce energy resources, etc).

The main principles of energy efficiency, as outlined in this program, are:

- Determination, throughout all sectors of the economy, of economically justified energy saving potential and its implementation.
- Increase the efficiency of fuel-energy resource consumption in all sectors of economy.
- Adoption of advanced technologies Provide of affordable consulting for fuel-energy consumers in efficient use of resources and products, as well as in decision making process.

The National Program on energy saving and renewable energy is directed at solving the following problems:

- Plan the development of energy resources of the country parallel to the advancement of energy saving and renewable energy, taking into account that increased energy efficiency usually has a low-cost nature.
- Synchronize the state policy on development of fuel-energy resources with the growth of the economy as a whole. This guarantees country-wide sustainable development through the introduction of regulatory reforms and an increase in public participation throughout the process.

- Direct the finance and credit policy of the country to energy saving and renewable energy development, providing equal conditions for capital investment.
- Establish and maintain an active market structure through introduction and explanation of energy efficiency benefits, providing an effective choice mechanism for market participants.
- Organize, promote and provide equal accessibility to modern technologies for all members of society, consumer and corporate alike.

## 2. General information

Table 1: Key information

|                      |                                |
|----------------------|--------------------------------|
| Official Name        | Republic of Armenia            |
| Head of State        | President Serzh Sargsyan       |
| Head of Government   | Prime Minister Tigran Sargsyan |
| National Legislature | National Assembly              |
| Capital              | Yerevan                        |
| Total Land           | Area 29800 km <sup>2</sup>     |
| Population           | 3,2 million                    |
| Official Language    | Armenian                       |
| Religion             | Christianity                   |
| Currency             | Dram                           |
| Time Zone            | GMT+4                          |

### 2.1. Geographical Location

The Republic of Armenia is a small landlocked country, located at the crossroads of Europe and Asia. Together with Georgia and Azerbaijan, Armenia is situated in the South Caucasus. The country occupies an area of 29,800 (km<sup>2</sup>) square, of which 28,400 km<sup>2</sup> are land and 1,400 km<sup>2</sup> are water. Armenia shares borders with Turkey to the west, Georgia to the north, Azerbaijan to the east, Nakhichevan to the southwest, and Iran to the south. The climate of Armenia is continental with the average temperature fluctuating between +18°C and +32°C in July-August (average 17.10°C) and between -13°C and +10°C in January (average -6.80°C).

The type of land is as follows: 37.2% mountains, 29.8% pasture, 21% arable land and 12% woodland. Armenia has deposits of copper, iron, molybdenum, gold, lead, silver, clay, limestone, zinc, as well as semi-precious and ornamental stones. Armenia is also rich in natural mineral waters. There are hundreds of natural wells throughout the country, as well as 10 natural lakes, 5 canyons, and numerous springs and torrents. Armenia's rivers, especially the Hrazdan, provide considerable hydroelectric power. Lake Sevan is the world's largest highland fresh water lake

(1,254 km<sup>2</sup>). It is located at 1,916 meters (m) above sea level. The country's highest peak is Mount Aragats (4,090 m).

## 2.2.Socio-Economic Background

Based on current official estimates, Armenia has a population of 3.2 million. The country is highly urbanized (64.1%) with an annual growth rate of 0.7%. Armenia was the most ethnically homogeneous country of the 15 ex-USSR republics. Currently, 95% of its population is ethnic Armenian. Russians are the second largest ethnic group (1.5%). Armenia has a worldwide Diaspora comprising about 5 million Armenians. The largest Diaspora communities are in Russia, USA, France, Germany and Iran. Armenian is the official language and is spoken by 99% of the population. Russian dominates as the second language. English is the third spoken language as a result of the country's integration into the world economy. Under the former Soviet central planning system, Armenia developed an industrial sector, supplying machine tools, military electronics, chemicals, textiles, shoes, carpets, and other manufactured goods in exchange for raw materials and fuel. The specialized industrial roles assigned to Armenia in the Soviet system offered, however, little of value to the world markets from which the Republic had been protected until 1991. Furthermore, about 30% of the previously-existing industrial infrastructure was damaged or lost in energy crisis of 1990. Basic economic data for Armenia is shown below in Table 2.

Table 2: Basic economic data for Armenia

|                                           | 2007  | 2008   | 2009  | 2010  | 2011  |
|-------------------------------------------|-------|--------|-------|-------|-------|
| Real GDP Growth (%)                       | 13,7  | 6,9    | -14,1 | 2,2   | 4,7   |
| Inflation Rate (% average)                | 6,7   | 5,2    | 6,5   | 9,4   | 4,7   |
| Total FDI (USD millions)                  | 582,3 | 1000,9 | 732,1 | 483   | 631,4 |
| Exchange Rate<br>(AMD/USD annual average) | 342,1 | 306    | 578,8 | 533,5 | 475,7 |

Source: National Statistical Service of the Republic of Armenia, Statistical Yearbook of Armenia, 2012.

Table 3: Structure of GDP of the Republic of Armenia 2006-2011

|                                          | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|------------------------------------------|------|------|------|------|------|------|
| Industry                                 | 17.9 | 15.1 | 13.3 | 13.5 | 14.8 | 16.0 |
| Agriculture                              | 18.1 | 17.5 | 16.3 | 16.9 | 17.4 | 20.7 |
| Construction                             | 24.5 | 25.6 | 25.3 | 18.6 | 17.1 | 12.6 |
| Services                                 | 31.3 | 32.0 | 21.6 | 40.4 | 39.5 | 39.9 |
| Taxes on products<br>(without subsidies) | 8.2  | 9.8  | 23.5 | 10.6 | 11.1 | 10.8 |

Source: Ministry of Economy of the Republic of Armenia

Armenia joined the World Trade Organization (WTO) in January 2003. Accordingly, Armenia has committed to liberalizing the regulatory framework of a number of industries: business services, communications, education, financial services, health and social services, and air transport services.

Armenia has succeeded in substantially decreasing inflation, stabilizing its currency, privatizing most of the small and medium-sized enterprises, and introducing some improvements to tax and custom administration.

Continuation of the overall progress will depend on the ability of the Government to strengthen its macroeconomic management, including: increasing revenue collection; improving the investment climate; reducing the influence of the executive on the judiciary; ensuring debt sustainability; and taking action against corruption.

Currently the negotiation for the Association Agreement with EU is in process.

### **2.3. Political situation**

According to the Constitution, which was adopted by national referendum on 5 July 1995 and subsequently amended by national referendum on 27 November 2005, Armenia is an independent and democratic country with a presidential form of government. The new constitution gave the President broad executive powers. The President is elected by popular vote for a five-year term and may serve no more than two consecutive terms. The Government of Armenia, which is headed by the Prime Minister, is the main executive body. The President, in consultation with parliamentary groups, appoints the Prime Minister supported by the majority of deputies. The President is also responsible for appointing members of the Government, as proposed by the Prime Minister. The National Assembly is the legislative body of the country (single-chambered with 131 seats of which the members serve four-year terms). The last parliamentary elections took place on 6 May 2012. The governing Republican party currently has the parliamentary majority.

The territory of the Republic of Armenia is divided into ten marzes (regions), plus the City of Yerevan: Aragats, Ararat, Armavir, Gegharkunik, Kotayk, Lori, Siunik, Shirak, Tavush, Vayots Dzor and Yerevan. These regions are headed by marzpets (governors). The highest appeal instance is the Appeals Court, which ensures the uniformity of law enforcement in the country through its final review of cases. The Constitutional Court rules on whether the decrees and decisions adopted by the National Assembly, the President and the Government comply with the Constitution of Armenia. Armenia's constitution guarantees a multiparty system. Since independence, Armenia has built a strong record of progress on democratic reform, which resulted in its accession to the Council of Europe in 2001. At the presidential elections held on 18

February 2013, the leader of the ruling Republican Party of Armenia Serzh Sargsyan, was elected President. There is a territorial dispute with Azerbaijan and the conflict has not yet been resolved. There are ongoing negotiations within the framework of the so-called Minsk Group, under the auspices of the Organization for Security and Cooperation in Europe (OSCE). At present, there are no diplomatic relations between Armenia and Azerbaijan, as well as between Armenia and Turkey, which seriously influences the economies of these countries and the entire region.

#### **2.4.Environmental Condition**

Armenia's environment became severely polluted during the Soviet period due to the introduction of heavy industries (such as the rubber and chemical plant in Nairit). In mid-1995, in attempts to offset a six-year energy crisis, the Armenian Government reactivated a nuclear power plant at Metsamor, which had closed in 1988 after the earthquake in northern Armenia. The energy crisis of this period led to deforestation when citizens scavenged for firewood. The draining of Lake Sevan, as a result of its use for hydropower, seriously threatens drinking water supplies as the lake is the major source of fresh water in the Republic.

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:

Armenia acceded to the following international conventions on environmental protection:

- UN Framework Convention on Climate Change (UNFCCC) (came into force on March 21 1994)
- 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;
- Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Basel, 1989)
- Wastes and their Disposal (came into force on May 5, 1992)
- Convention on the Environmental Impact Assessment in a Transboundary Context (Espo, 1991)
- 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.
- 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%).

## 2.5. Energy Outlook

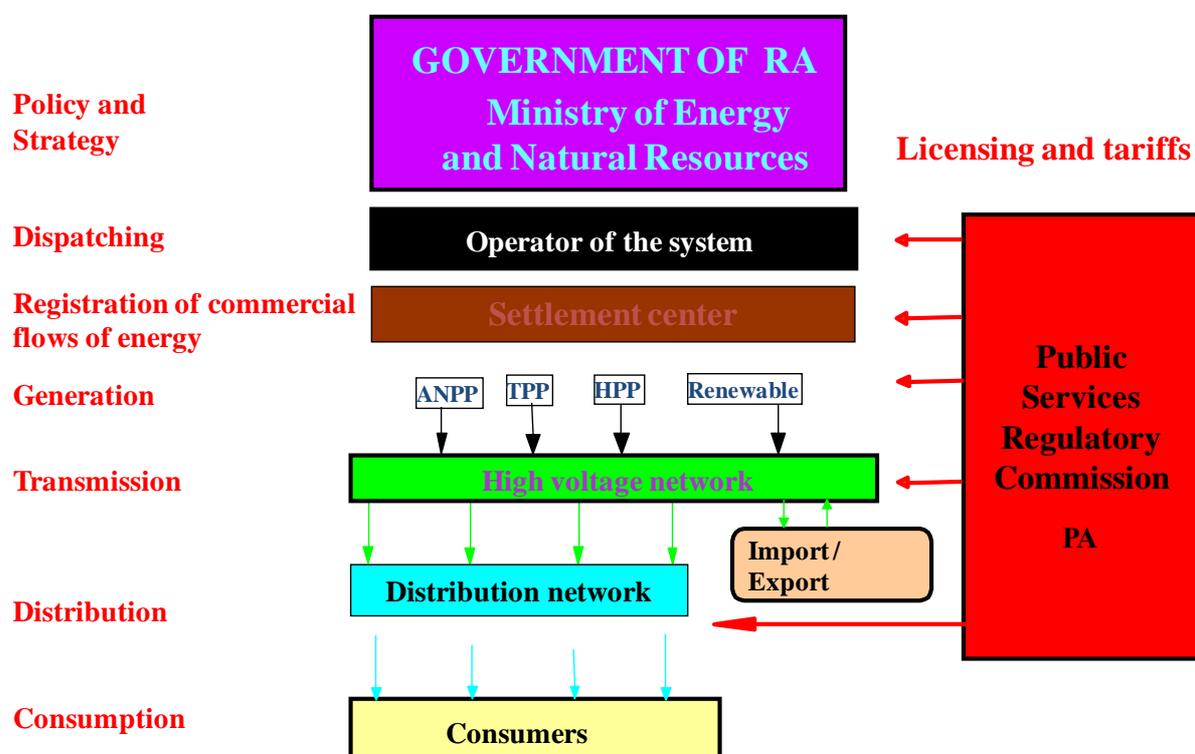
Now the energy sector in Armenia is one of the cost-effective and dynamically developing industries of our economy. It fully covers the domestic energy demands and as successfully performs the energy exchange program with two neighboring countries on mutually beneficial basis.

Table 4: Total electricity production

| Year | Billion kWh |
|------|-------------|
| 2007 | 5, 9        |
| 2008 | 6, 1        |
| 2009 | 5, 6        |
| 2010 | 6, 4        |
| 2011 | 7, 4        |
| 2012 | 7,4         |

### Functional Structure of Energy System of Republic of Armenia

## Functional Structure of Armenian Energy system



The power sector is separated into three sub-sectors: generation, transmission, and distribution. Transmission, dispatch, and settlements companies tasked with delivering power from diversely owned generating facilities to a single, privately owned distribution entity called Electricity Network of Armenia (ENA). Dispatching is performed by the Power System Operator.

In terms of hierarchy of the institutional organization of the power sector of the Republic of Armenia, The Ministry of Energy and Natural Resources is responsible for the general policy and the development of the long term development strategy of the sector, the Public Services Regulation Commission is responsible for regulation activities and the CJSC "High-Voltage Electricity Network" is responsible for planning, development and operation of the transmission system.

**Table 5:** Generation Capacity by Source and Ownership.

| <b>Installed Capacity and Ownership of Armenia's Power Plants</b> |                    |                        |
|-------------------------------------------------------------------|--------------------|------------------------|
| <b>Generation Type &amp; Name</b>                                 | <b>Capacity MW</b> | <b>Owner</b>           |
| Thermal                                                           | <b>2476</b>        |                        |
| Hrazdan TPP                                                       | 1110               | Inter RAO UES RF       |
| Hrazdan 5 <sup>th</sup> Unit                                      | 480                | ArmRusGazprom          |
| Yerevan TPP                                                       | 790                | Government RA          |
| Vanadzor TPP                                                      | 96                 | RF                     |
| Hydropower                                                        | <b>1146</b>        |                        |
| Sevan-Hrazdan cascade                                             | 559                | "RusGidro" RF          |
| Vorotan cascade                                                   | 404                | Government RA          |
| Dzora HPP                                                         | 26                 | Private owner RA       |
| Small HPPs                                                        | 157                | Various private owners |
| Wind+other                                                        | <b>12,6</b>        |                        |
| Lori-1 WPP                                                        | 2,6                | Government RA          |
| Other                                                             | 10                 | Various private owners |
| Nuclear                                                           | <b>407</b>         | Government RA          |
| <b>Total</b>                                                      | <b>4042</b>        |                        |

Source: Ministry of Energy and Natural Resources

### **3. National Energy Efficiency and Energy Saving Programme**

The main programmatic document in the sphere of energy saving and energy efficiency is “National Program on Energy Saving and Renewable Energy of RA”. It is ratified by the Government of RA in 2007.

**The National Program is directed to achieving the following goals:**

1. Support for the sustainable development of the Armenian economy.
2. Through development of energy saving and renewable energy systems, decrease the dependence on foreign energy suppliers and avoid interruptions in the Armenian fuel supply.
3. Alleviate the inefficient growth of the energy sector by securing intensive implementation of energy efficiency measures.
4. Efficient consumption of fuel-energy resources and maximal employment of renewable energy resources, through application of targeted economic and legal mechanisms.
5. Develop practical measures for achieving the targets set by this program. This includes the development and application of modern technologies and management practices.

The main principles of energy efficiency, as outlined in this program, are:

1. Determination, throughout all sectors of the economy, of economically justified energy saving potential and its implementation.
2. Increase the efficiency of fuel-energy resource consumption in all sectors of economy.
3. Adoption of advanced technologies and work schedules for consumers of fuel-energy resources.
4. Provide of affordable consulting for fuel-energy consumers in efficient use of resources and products, as well as in decision making process.

The National Program on energy saving and renewable energy is directed at solving the following problems:

- Synchronize the state policy on development of fuel-energy resources with the growth of the economy as a whole. This guarantees country-wide sustainable development through the introduction of regulatory reforms and an increase in public participation throughout the process.
- Direct the finance and credit policy of the country to energy saving and renewable energy development, providing equal conditions for capital investment.
- Establish and maintain an active market structure through introduction and explanation of energy efficiency benefits, providing an effective choice mechanism for market participants.

- Organize, promote and provide equal accessibility to modern technologies for all members of society, consumer and corporate alike.

### **3.1.Principal Institutions and Organizations Responsible for Energy Efficiency and Energy Saving Policies and Programmes**

By its Decree No. 55 of January 25, 2005, the Armenian Government designated the Ministry of Energy as the government authority in charge of energy efficiency policy implementation. Other government bodies of the Republic of Armenia (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.

Armenia Renewable Resources and Energy Efficiency Fund (R2E2) is an independent legal entity (Foundation) established in 2006 by the Government of Armenia following the “Law on Energy Efficiency and Renewable Energy” of Armenia. The R2E2 Fund promotes the development of EE and renewable energy (RE) markets in Armenia by facilitating investments in the EE and Re sector. R2E2 has efficient financing mechanism through a revolving lending tool to finance energy efficiency and renewable energy projects through the banks or credit organizations.

The Fund has directly and indirectly through on lending via local banks –invested in energy-efficient heating and renewable energy projects. It also conducts annual monitoring of schools’ heating system, collects and elaborates primary data, carries out verification projects and prepares monitoring reports.

The proposed investments, as a rule, are small in scale with limited and well known impacts on the environment, which normally can be mitigated or eliminated by adhering to good construction practice. Nevertheless the Environmental Management Plan for each project was developed, which describe the potential threats and the ways of avoiding and/or mitigating them.

The R2E2 has developed working relationship and partnership with major state, private and international organizations and companies in Armenia including the Government of Armenia (Minister of Energy and Natural Resources is the Head of Board of Trustees), Public Services Regulatory Commission, the Central Bank, the World Bank, EBRD, EU, USAID, UNDP, UNIDO, KfW and their projects’ teams, as well as number of local and international companies, private banks, gas and electricity supply companies, High Voltage Network, Gas supply company, Association of Small Hydro PP (SHPP) owners, more than 60 SHPPs, Enterprise Incubator Foundation, Armenian Development Agency, Alliance to Save Energy, Enertech inc, BBI international, etc. Throughout the implementation of its activities the Fund is in close

cooperation with National Academy of Science, American University of Armenia, National Renewable Energy Laboratory (USA), as well as other research institutions.

### 3.2. Existing Energy Efficiency and Energy Saving Policies and Programmes;

Armenia has significant potential to save energy through efficiency (EE) investments. According to the GoA' Energy Efficiency Action Plan (EEAP) for 2011-2020, investments to improve EE could reduce annual consumption of electricity and natural gas by 1 TWh and 600 million m<sup>3</sup>, The (EEAP) focuses on improving energy efficiency in public, commercial and residential building, industrial production, and transport.

| No | Title of the EEI measure                                                                    | end-use EEI action targeted                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Responsibility                                                                                                                                  | Duration                  |
|----|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| 1  | Information campaigns, training and education in the area of energy efficiency improvements | <p>Organising and running information campaigns and educational projects on energy efficiency and financial support for actions relating to the promotion of energy efficiency.</p> <ul style="list-style-type: none"> <li>○ Run nationwide campaigns on efficient energy use.</li> <li>○ Organise and run information campaigns on the desirability of and savings from the use of the most energy efficient products.</li> <li>○ Financial support for measures relating to the promotion of energy efficiency from national funds</li> <li>○ Develop and introduce new techniques and technologies particularly as regards efficient use of fuel for heating.</li> <li>○ Information and education actions aimed at changing consumer behaviour and</li> </ul> | <p>Ministry of Energy and Natural Resources of RA<br/>R2E2,</p> <p>Ministry of education and science of RA</p> <p>Ministry of Economy of RA</p> | 2010-2015 ongoing process |

|   |                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                      |           |
|---|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|-----------|
|   |                                                                                               | <p>increasing social acceptance of solutions that improve energy efficiency in households, tertiary sector and industry.</p> <ul style="list-style-type: none"> <li>○ Encourage providers and consumers to pay more attention to energy efficiency labelling and to the energy consumption of products bought</li> <li>○ and sold.</li> <li>○ Training for sales staff as regards energy efficiency labelling and product life cycle costs.</li> <li>○ Creation of a training system for energy efficiency specialists within tertiary education, as part of various disciplines.</li> <li>○ Introduction of energy efficiency subjects into education programmes at all levels.</li> </ul> |                                                                                                                                      |           |
| 2 | Green public procurement (GPP) initiative for purchase of equipment for public administration | <p>Green public procurement means that public purchasers take account of environmental factors when buying products, services or works. It is proposed to rely on existing guidelines (e.g. EU) for public authorities and contracting parties to introduce technical specifications and evaluation criteria for the purchase of public goods and services, e.g. in the fields of:</p> <ul style="list-style-type: none"> <li>○ lighting</li> <li>○ ICT and office equipment</li> <li>○ air-conditioning and</li> </ul>                                                                                                                                                                     | Public Procurement Agency (under Government) Ministry of Nature Protection, Ministry of Finance, Ministry of Urban Development of RA | 2012-2015 |

|  |                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                   |            |
|--|------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|------------|
|  |                                                                                                                                                | <p>cooling</p> <ul style="list-style-type: none"> <li>○ household appliances (e.g. refrigerators, washing-machines, coffee-machines)</li> <li>○ vehicles</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                   |            |
|  | Improvement of Energy Efficiency legislation                                                                                                   | <p>Urban Code Acceptance, which will include building energy characteristics (comparable with the best international practices, as the energy characteristics of buildings directive).</p> <p>The New Code will take into account the full energy characteristics of buildings (including heating, hot water supply, ventilation) and define specific targets for maximum energy demand of buildings. The construction permits should be given only if the new order requirements are met.</p> <p>Working out of technical regulations, energy saving national standards and technical conditions.</p> <p>Harmonization of standards on household energy efficiency testing devices.</p> <p>Harmonization and development of standards and calculation methodology for the evaluation of building energy performance.</p> | The Ministry of Urban Development, The Ministry of Energy and Natural Resources and the Ministry of Economy of RA | continuous |
|  | Establish quality assurance / control standards (QA / QC), which will provide the main materials certification with the energy characteristics | <p>To establish a system of mandatory testing to ensure compliance with national construction standards.</p> <p>Define requirements for manufactured and imported building materials, which allow designers and constructors to take more informed decisions on used materials characteristics for the construction of new buildings.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Ministry of Urban Development, Ministry of Economy of RA                                                          |            |

|  |  |                                                                                                                                                                       |  |  |
|--|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
|  |  | Input certification and labeling system for building materials (such as windows, insulation, boilers, etc.) to promote high-quality materials entrance to the market. |  |  |
|--|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|

### **3.3.Implementation of Energy Efficiency and Energy Saving Policies and Programmes;**

Apart from the generated energy and cost savings, energy efficiency is one necessary condition to diversify Armenia’s energy supply and thus improve economic competitiveness. And this can be achieved at less cost than investing into new production capacities or energy imports. Energy efficiency investments are in general economically and financially viable, especially the public sector investments provide the highest return on investment overall.

Potential ways to implement the NESP are:

- providing economic incentives to EE 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 encourage energy efficiency, Armenia has so far taken several steps on the political and programmatic level:

- Created a legal framework for energy efficiency. In 2005, the Government passed a Law on Energy Savings and Renewable Energy, and has since passed draft building codes (for new buildings) which mandate energy efficiency.
- Developed a National Program on Energy Savings and Renewable Energy with solid data on energy use and energy efficiency in Armenia.
- Has taken steps to improve the economic efficiency of energy use through improved regulation of energy utilities. Several barriers to economic efficiency which also affect the efficiency of energy resource use—for example, highly subsidized energy tariffs, or the absence of electricity and gas metering—have been largely removed in Armenia.
- Continued to work actively with development partners like the World Bank, the UN Development Programme, the EBRD, USAID and other donors on energy

efficiency programs to improve the energy supply infrastructure (electricity and heat production facilities, transmission and distribution networks) and heat energy use in public and residential buildings.

### 3.4. Envisaged Energy Efficiency and Energy Saving Programmes

The updating Energy Development Strategy is being prepared by the Ministry of Energy and Natural Resources of RA, which will include the envisaged programmes in the energy efficiency and energy saving sphere.

After signing the Association Agreement with EU the implementation of the following directives are foreseen:

|            |                                                                                                                                                                                                                                                          |                |                                                                             |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------------------------------------------------------------------|
| <b>2.</b>  | <b>Energy Efficiency</b>                                                                                                                                                                                                                                 |                |                                                                             |
| <b>2.1</b> | <b>Labeling</b>                                                                                                                                                                                                                                          |                |                                                                             |
|            | <u>Directive 2010/30/EU</u> on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products                                                                                  | within 5 years | Ministry of Energy and Natural Resources;<br>Ministry of Economy            |
|            | Directive 2010/31/EU of 19 May 2010 on the energy performance of buildings.                                                                                                                                                                              | within 5 years | Ministry of Energy and Natural Resources;<br>Ministry of Civil Construction |
|            | <u>Commission Directive 2003/66/EC</u> of 3 July 2003 amending Directive 94/2/EC implementing Council Directive 92/75/EEC with regard to energy labelling of household electric refrigerators, freezers and their combinations (Text with EEA relevance) | within 5 years | Ministry of Energy and Natural Resources;<br>Ministry of Economy            |
|            | <u>Commission Directive 2002/40/EC</u> of 8 May 2002 implementing Council Directive 92/75/EEC with regard to energy labelling of household electric ovens (Text with EEA relevance)                                                                      | within 5 years | Ministry of Energy and Natural Resources;<br>Ministry of Economy            |
|            | <u>Commission Directive 2002/31/EC</u> of 22 March 2002 implementing Council Directive 92/75/EEC with regard to energy labelling of household air-conditioners                                                                                           | within 5 years | Ministry of Energy and Natural Resources;<br>Ministry of Economy            |

|  |                                                                                                                                                                                                                       |                |                                                                  |
|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------------------------------------------------------------|
|  | (Text with EEA relevance)                                                                                                                                                                                             |                |                                                                  |
|  | <u>Commission Directive 1999/9/EC</u> of 26 February 1999 amending Directive 97/17/EC implementing Council Directive 92/75/EEC with regard to energy labelling of household dishwashers (Text with EEA relevance)     | within 5 years | Ministry of Energy and Natural Resources;<br>Ministry of Economy |
|  | <u>Commission Directive 98/11/EC</u> of 27 January 1998 implementing Council Directive 92/75/EEC with regard to energy labelling of household lamps (Text with EEA relevance)                                         | within 5 years | Ministry of Energy and Natural Resources;<br>Ministry of Economy |
|  | <u>Commission Directive 97/17/EC</u> of 16 April 1997 implementing Council Directive 92/75/EEC with regard to energy labelling of household dishwashers (Text with EEA relevance)                                     | within 5 years | Ministry of Energy and Natural Resources;<br>Ministry of Economy |
|  | <u>Commission Directive 96/89/EC</u> of 17 December 1996 amending Directive 95/12/EC implementing Council Directive 92/75/EEC with regard to energy labelling of household washing machines (Text with EEA relevance) | within 5 years | Ministry of Energy and Natural Resources;<br>Ministry of Economy |
|  | <u>Commission Directive 96/60/EC</u> of 19 September 1996 implementing Council Directive 92/75/EEC with regard to energy labelling of household combined washer-driers                                                | within 5 years | Ministry of Energy and Natural Resources;<br>Ministry of Economy |
|  | <u>Commission Directive 95/13/EC</u> of 23 May 1995 implementing Council Directive 92/75/EEC with regard to energy labelling of household electric tumble driers                                                      | within 5 years | Ministry of Energy and Natural Resources;<br>Ministry of Economy |
|  | <u>Commission Directive 95/12/EC</u> of 23 May 1995 implementing Council Directive 92/75/EEC with regard to energy labelling of household washing machines                                                            | within 5 years |                                                                  |
|  | <u>Commission Directive 94/2/EC</u> of 21 January 1994 implementing Council Directive 92/75/EEC with regard to energy labelling of household electric refrigerators, freezers and their combinations                  | within 5 years | Ministry of Energy and Natural Resources;<br>Ministry of Economy |

|            |                                                                                                                                                                                                                                                                        |                                 |                                                                                                        |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|--------------------------------------------------------------------------------------------------------|
|            | <u>Council Directive 92/75/EEC</u> of 22 September 1992 on the indication by labelling and standard product information of the consumption of energy and other resources by household appliances                                                                       | within 5 years                  | Ministry of Energy and Natural Resources;<br>Ministry of Economy                                       |
|            | <u>Regulation (EC) No 106/2008</u> of 15 January 2008 on a Community energy-efficiency labelling programme for office equipment                                                                                                                                        | within 5 years                  | Ministry of Energy and Natural Resources;<br>Ministry of Economy                                       |
|            | <u>Council Decision of 18 December 2006 concerning conclusion of the Agreement between the Government of the United States of America and the European Community on the coordination of energy-efficiency labelling programmes for office equipment [2006/1005/EC]</u> | within 5 years                  | Ministry of Energy and Natural Resources;<br>Ministry of Economy                                       |
|            | <u>Regulation (EC) No 1222/2009</u> of the European Parliament and of the Council of 25 November 2009 on the labelling of tyres with respect to fuel efficiency and other essential parameters                                                                         | 8 years after the signing of AA | Ministry of Energy and Natural Resources;<br><br>Ministry of Transport and Communication               |
| <b>2.3</b> | <b>Eco-design</b>                                                                                                                                                                                                                                                      |                                 |                                                                                                        |
|            | Directive 2009/125/EC on establishing a framework for the setting eco-design requirements for energy-related products.                                                                                                                                                 | within 7 years                  | Ministry of Energy and Natural Resources;<br>Ministry of Economy;<br><br>Ministry of Nature Protection |
|            | Implementing Directives/Regulations:                                                                                                                                                                                                                                   |                                 |                                                                                                        |
|            | Commission Regulation (EC) No 278/2009 on eco-design requirements for no-load condition electric power consumption and average active efficiency of external power supplies.                                                                                           | within 8 years                  | Ministry of Energy and Natural Resources                                                               |
|            | Commission Regulation (EU) No 347/2010 amending Commission Regulation (EC) No 245/2009 as regards the ecodesign requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and                                | within 8 years                  | Ministry of Energy and Natural Resources;<br><br>Ministry of Economy                                   |

|  |                                                                                                                                                                                                                     |                |                                                                                                                           |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------------------------------------------------------------------------------------------------------------------|
|  | luminaries able to operate such lamps.                                                                                                                                                                              |                |                                                                                                                           |
|  | Commission Regulation (EC) No 245/2009 on eco-design requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaries able to operate such lamps. | within 8 years | Ministry of Energy and Natural Resources;<br>Ministry of Economy                                                          |
|  | Commission Regulation (EC) No 244/2009 on eco-design requirements for non-directional household lamps.                                                                                                              | within 8 years | Ministry of Energy and Natural Resources;<br>Ministry of Economy;<br>Ministry of Civil Construction, Yerevan Municipality |
|  | Commission Regulation (EC) No 107/2009 on eco-design requirements for simple set-top boxes.                                                                                                                         | within 8 years | Ministry of Energy and Natural Resources;<br>Ministry of Economy                                                          |
|  | Commission Regulation (EC) No 1275/2008 on eco-design requirements for standby and off mode electric power consumption of electrical and electronic household and office equipment.                                 | within 8 years | Ministry of Energy and Natural Resources;<br>Ministry of Economy                                                          |
|  | <u>Commission Regulation (EC) No 641/2009 on ecodesign requirements for glandless standalone circulators and glandless circulators integrated in products.</u>                                                      | within 8 years | Ministry of Energy and Natural Resources;<br>Ministry of Economy                                                          |
|  | Commission Regulation (EC) No 640/2009 on ecodesign requirements for electric motors.                                                                                                                               | within 8 years | Ministry of Energy and Natural Resources;<br>Ministry of Economy                                                          |
|  | Commission Regulation (EC) No 643/2009 on ecodesign requirements for household refrigerating appliances.                                                                                                            | within 8 years | Ministry of Energy and Natural Resources;<br>Ministry of Economy                                                          |
|  | Commission Regulation (EC) No 642/2009 of on ecodesign requirements for televisions.                                                                                                                                | within 8 years | Ministry of Energy and Natural Resources;<br>Ministry of Economy                                                          |

|  |                                                                                                                      |                |                                           |
|--|----------------------------------------------------------------------------------------------------------------------|----------------|-------------------------------------------|
|  | Council Directive 92/42/EEC on efficiency requirements for new hot-water boilers fired with liquid or gaseous fuels. | within 8 years | Ministry of Energy and Natural Resources; |
|--|----------------------------------------------------------------------------------------------------------------------|----------------|-------------------------------------------|

The project will be supported by US\$8.3 million from government funding, US\$1.82 million from the GEF grant, and US\$0.54 million co-financing from the Renewable Resources and Energy Efficiency Fund (R2E2 Fund). The Government funding will include the taxes and, during the project life, the repayments of the revolving funds under now-closed Bank projects – Urban Heating Project and Renewable Energy Project. The R2E2 Fund co-financing will originate from service fees and interest under the proposed Energy Service Agreements within framework of the project. The project funds would be channeled from the R2E2 Fund to social and other public facilities for energy efficiency retrofits.

The project development objective is to reduce energy consumption of social and other public facilities. The global environmental objective is to decrease greenhouse gas emissions through the removal of barriers to the implementation of energy efficiency investments in the public sector.

The Project consists of the following parts:

#### Energy Efficiency Investments in Public Facilities

**Component 1: Energy efficiency investments in public facilities** (estimated cost of US\$8.7 million, including US\$8.0 government funding and US\$0.7 million GEF grant). This component will support energy efficiency investments in social and other public facilities, e.g. schools, kindergartens, hospitals, administrative buildings, street lighting. The energy efficiency investments will reduce the energy consumption of retrofitted public and social facilities and reduce the CO<sub>2</sub> emissions. Additionally, these investments will generate substantial social benefits, including increased quality of education, improved health.

#### Technical Assistance

**Component 2: Technical assistance** (estimated cost of US\$1.96 million, including US\$1.12 million GEF grant, US\$0.54 million R2E2 co-financing and US\$0.3 million Government co-financing). This component will help remove the existing barriers to realizing the energy efficiency potential and create an enabling environment for energy efficiency in the public sector. The key areas that this component will finance include: (a) capacity building of the R2E2 Fund, including training and basic audit and monitoring equipment; (b) pipeline development and capacity building to participating public agencies, to address knowledge gaps on energy efficiency, build the demand for program financing, and improve the prospects for the sustainability of energy savings generated under the project; (c) policy development support, including efforts to support budgeting, procurement and financing of energy efficiency projects in the public sector, as well as select policy measures and energy statistics; (d) market development and capacity building

of various market actors, including ESCOs, banks, construction firms; and (e) project management, including monitoring, reporting and financial audits.

### **3.5. Mutual Cooperation in Energy Efficiency and Energy Saving with other CIS Countries**

The significant part of energy sector development strategy is realization of projects on securing the diversification of primary energy sources supplies, regional integration and market relations. It is obligatory that Armenia should be involved in the regional power market that is currently in the process of formation and foresees the formation of a circular power system of Black Sea countries as well as creation of North-South parallel operation relations (Russia-Georgia-Armenia-Iran and others). Reasonably efficient and perspective will become connection of Armenian power system with Black Sea Power Ring, which is currently in process of formation.

Armenia's policy now is to begin emerging as a regional player in a number of sectors, and there is growing interest in power markets of the region in the long term prospects of the Armenian economy. Power export/import, transit activities within the region, in our opinion, is key to this process of regional and global economic integration. Armenia occupies a highly strategic position at the crossroads between Europe and Asia, and is in a position to help forge a more supportive regional environment.

To address the above issues and objectives, benchmarking analysis of the competitiveness of electricity generated in Armenia in the region is carrying out by the assistance of USAID. In other words a regional market study will allow understanding the existing technical and commercial potential of electricity exports from Armenia to neighboring countries taking into account the Armenia's regional setting.

Particular emphasis was put on the construction of two new transmission lines aiming to secure parallel work of Armenia-Georgia and Armenia-Iran power systems, with final goal of parallel work of joint power systems of all three countries, which will significantly improve the quality of the service and will have a great impact for regional cooperation in the sphere of energy.

Realization of projects on construction of two 400 kV OHL with Georgia and Iran will be a step to set in motion the parallel work of power systems of CIS countries. The complete solution of this issue will provide the possibility for Georgia to export to southern markets the surplus of electricity generated during spring floods and for Armenia to construct reliable inter-connection towards integration to CIS unified power system and access to mentioned regional electricity market.

Access to CIS electricity market and mutual efficient parallel work with CIS unified power system will allow Armenia to use the optimization regime and balancing effects resulting from different time zones, while the CIS unified power system will have an additional opportunity of access to South Caucasus electricity market.

The capacity of the existing high-voltage network is considered sufficient for the current and the forecast domestic loads. Armenia has power interconnections with all neighbouring countries. The electricity interconnections with neighbouring countries are shown in the following table:

**Table 8:** Information on Armenia’s Electricity Interconnections. Source: Ministry of Energy and Natural Resources

| Country    | Connection Type               | Operational state  |
|------------|-------------------------------|--------------------|
| Azerbaijan | Line HVL-330 kV (100 km)      | Out of Service     |
|            | Line HVL-220 kV (63.5 km)     | Out of Service     |
|            | Line HVL-110 kV (98 km)       | Out of Service     |
|            | Line HVL-110 kV (30 km)       | Out of Service     |
| Georgia    | One line HVL-220 kV (65 km)   | Operational        |
|            | One line HVL-110 kV (35.8 km) | Operational        |
|            | One line HVL-110 kV (19 km)   | Operational        |
|            | One line HVL-400 kV           | Under construction |
| Turkey     | One line HVL-220 kV (65 km)   | Out of Service     |
| Iran       | One line HVL-220 kV (78.5 km) | Operational        |
|            | One line HVL-220 kV           | Operational        |
|            | One line HVL-400 kV           | Under construction |

The operator of the transmission system is High Voltage Grids CJSC, a state-owned company. Work has begun on rehabilitation of 220 kV substations.

Currently the mutual cooperation is within the frameworks of Economic Council of CIS countries and Electricity Council of CIS countries.

### **3.6. Mutual Cooperation in Energy Efficiency and Energy Saving outside the CIS Region**

The European Bank for Reconstruction and Development (EBRD) has initiated in Armenia through partner banks a 20 million USD credit line that is targeting private Armenian companies in all sectors, which intend to invest in energy efficiency or renewable energy projects. This credit line is a part of the Armenian Sustainable Energy Financing Facility (ArmSEFF) which was officially launched in November 2010. ArmSEFF is supported by a substantial and complex free technical assistance that is provided by the team of international and local experts (ArmSEFF-team) to the companies and participating banks, in order to overcome a number of barriers that may hinder the implementation of the projects.



Renewable Energy Project funded by the World Bank Renewable Energy (RE) Project. The development of Renewable energy in Armenia is considered to be one of the four supporting columns for the strategy of the energy efficiency and total technological development policy in the country. The R2E2, with support of World Bank credit and Global Environment Facility Trust Fund, implemented the Renewable Energy (RE) Project. The Project's objective is to increase the share of electricity generated by privately owned facilities operating on renewable sources. The project's global objective is to reduce emissions of carbon dioxide (CO<sub>2</sub>) of green-house gases by abolishing the factors impeding the renewable energy development. One of the Project directions aims at promoting the investments in the sector and within its framework it is conducted reformation of the legal field, evaluation of renewable sources, study of different technology applications, ecological consideration, public information and etc. The second direction is the long-term credit resources allocated for construction or strengthening of wind and small hydro power plants. In certain RE directions (solar photovoltaic convertors /SPC/, bio-fuel production – first of all bio-ethanol production, geothermal energy, hydrogen energy, fuel batteries) there is already a considerable scientific and personnel potential in Armenia and in certain cases (e.g. hydrogen energy, fuel batteries) there is an exceptional potential for our country. In a number of enterprises and organizations of the country a small scale SPC production, installation and operation is realized, technological processing is carried out for modern PV elements, sensors/transducers and other equipment - also by application of nanotechnologies. The creation of Geographical Informative System /GIS/ of Renewable Energy in RA Lori province has led to a very good result, the realization of which allows to cumulate new knowledge and skills in the republic, to combine data previously under different administrations' subjection and to enhance the implementation efficiency of RE projects in Armenia. This is a comprehensive and multi-sphere system, consists of interconnected data bases and the very GIS. The main objective is to develop, create and put into operation the bilingual (Armenian, English) GIS in Armenia and available via Internet. In order to support to the implementation of Renewable Energy Project, the Development Credit Agreement was signed on April 7, 2006 between the Republic of Armenia

and International Development Association, whose purpose is to increase the industrial capacities and production volumes in renewable energy sector, as well as to reduce the emissions of greenhouse gasses.

Urban Heating Project funded by the World Bank The Urban Heating Project /UHP/ objective is to increase usage of clean, productive, safe and available heating technologies in RA multi-storied buildings and schools. A number of activities have been implemented within UHP framework, including improvement of regulation, safety norms and standards, rendering of heating services, developing capabilities of local financial organizations and communities, implementing large-scale informative campaigns and public informative projects, *promoting* financial sector to finance heating options. The Banks, selected by the R2E2, implement broad lending program. In order to improve the heating services the Banks provide sub-credits to the apartment owners – both for private apartment heating and for organizing the heating by collective solutions.

The R2E2, as an agent of the Government, implements the restoration works of the schools heating system. Instead of envisaged 100 schools, the Fund has implemented construction works of the whole system of the boiler and heating in more than 120 schools and energy efficiency activities in 13 schools (thermal insulation of walls, attic, installation of doors, windows and etc.). In selected urban schools the installation and rehabilitation works of local thermal systems operating on gas have been implemented.. All the schools were selected by the principle of investments efficiency (investment per student) In addition to Urban heating Project component - Global Partnership Output-based Aid Project has approved the provision of direct grant to the amount of 3.1 mln. to the R2E2 for ensuring connection of the apartments of vulnerable families to the systems of gas and thermal supply. When realizing MHP components and GPOBA grant project for usage of credit and grant funds the same approach is applied. In addition by Urban Heating Project Component B it is envisaged USD 3 mln. allocation and co-financing by the Government totaled to USD 530,000.

Global Partnership Output-based Aid (GPOBA) is a Fund of multi-donor financing and acting under the supervision of the World Bank, which has allocated USD 3.1 mln. to R2E2 Fund for provision of capital grants to more than 8000 low income families living in urban multi-apartment buildings. The Fund provided gas connection and efficient and safe heater installation.

**IFC Armenia Sustainable Energy Finance Project** The IFC Sustainable Energy Finance Project is designed to establish a sustainable market for energy efficiency and renewable energy investments and contribute to the energy self-sufficiency of Armenia through work with local and in partnership with international financial institutions.

## The IFC Approach.

1. Supporting the development of renewable energy financing through financial institutions. The Project seeks to educate local financial institutions and provide them with advisory services that will allow them to access and market renewable energy financing products.
2. Create a platform to support financial institutions in the development and marketing of energy efficiency lending. IFC will enter into advisory service agreements with partner financial institutions in the region in order to develop energy efficiency awareness and internal capacity.
3. Improve the regulatory framework for the development of renewable energy. The Project will focus on addressing the existing regulatory issues associated with the Power Purchase Agreement and the feed-in tariff for renewable energy technologies.
4. Increase the awareness of renewable energy project developers and the expertise of local design companies on the application of modern design solutions and new technologies to ensure the long-term sustainability of renewable energy projects. The Project intends to organize workshops and conferences in close cooperation with the Union of Small Hydropower Plants and other local organizations in order to demonstrate to renewable energy developers and designers international best practices.

Build awareness and market demand for sustainable energy finance through a broad public awareness campaign. The Project will undertake a structured market development and public awareness campaign to educate key stakeholders including policy makers, financial institutions, and small and medium enterprises about the potential benefits of Armenia Sustainable Energy Finance Project. IFC will draw upon applicable awareness campaign techniques in neighboring regions to promote these products.

*EBRD and Ministry of Energy and Natural Resources of the Republic of Armenia* signed a Memorandum of Understanding on a Sustainable Energy Action Plan for Armenia (SEAP). This initiative aims to assist Armenia in reducing the energy intensity of its economy and promoting energy efficiency investments in various sectors of economy, such as power and energy, industry, agriculture, municipal and environmental infrastructure, property, as well as in the residential sector. The Sustainable Energy Action Plan, developed jointly by the Ministry of Energy and Natural Resources and the EBRD, represents an important step forward in promoting the further development of Armenia's energy sector and securing long term sustainable energy supplies. A special focus will be given to the promotion of energy efficiency across industrial and residential sectors helping Armenian companies and

households to reduce their energy consumption and cost. This initiative can also assist Armenia to utilize its big potential for the development of the hydro power plants (HPPs). The Sustainable Energy Action Plan for Armenia will assist the Armenian government in developing necessary legislation for energy efficiency investments and in developing financing initiatives to support investments in energy efficiency, renewable energy and possible carbon financing opportunities. The EBRD is one of the largest investors in Armenia. Since the beginning of its operations there in 1992, the EBRD has invested over €516 million in 106 projects in the country's financial, corporate, energy and infrastructure sectors.

Currently the affiliate of the **Eastern Europe Energy Efficiency and Environment Partnership (E5P)** Fund is in the process.

The Eastern Europe Energy Efficiency and Environment Partnership (E5P) is a multi-donor fund established in 2009 during Sweden's Presidency of the European Union. Initially launched for Ukraine, the intention was that the fund shall cover the Eastern Partnership countries (Armenia, Azerbaijan, Georgia and Moldova in addition to Ukraine) for municipal energy efficiency and environmental projects.

The key objectives of the Fund are

- Improvement of energy efficiency,
- Significant reduction of CO<sub>2</sub> and
- Other Green House Gas emissions,
- Enhanced economic competitiveness and affordability of assets maintenance.

The Partnership is implemented through a Fund denominated in Euro. The purpose of the Fund is delivery of coordinated and effective international financial support by combining grant contributions from a group of donors and beneficiary countries. Grants will be used for either technical assistance or investment grants.

EBRD, EIB, NIB, NEFCO, IBRD, IFC and any other International Financial Institution (IFI) may act as Implementing Agencies (IA) for the Fund.

### **Covenant of Mayors**

On 12 November 2012 the Ministry of Energy and Natural Resources of the Republic of Armenia and the Association of European Municipalities "Energy Cities" which is the consortium leader that implements the Project of the European Commission N°265-434 "Supporting participation of Eastern Partnership and Central Asian Cities in the Covenant of Mayors", acting under the Articles of the the Service Contract ENPI/2011/ 265-434 - "Supporting participation of Eastern

Partnership and Central Asian Cities in the Covenant of Mayors" signed with the Directorate-General for Development and Cooperation- EuropeAid of the European Commission.

The Parties are considering cooperating in the following areas:

- effective and secure energy supply of cities;
- reduction of use of conventional energy sources in cities,
- increase of energy efficiency of cities;
- increase of share of renewable energy in municipal energy balances,
- reduction of CO2 emission.

#### **4. Potential and Drivers for Energy Efficiency and Energy Saving Improvements**

Investments in energy efficiency can save Armenia roughly 1 TWh of electricity and 600 million m<sup>3</sup> of natural gas, equal to 17 percent of total electricity generated and 32 percent of total natural gas consumed in 2007. Nearly all of this reduction can be achieved through AMD 124 billion investments (of which 99 percent are economically and 97 percent financially viable), in other words, the investments save energy and money for Armenia as a whole as well as for individual entities that make the investment.

The greatest annual savings are in the utilities sector.

In the utilities sector, Armenia could save more than AMD 45 billion per year primarily by replacing or upgrading old gas-fired equipment, the largest examples of which are the Yerevan and Hrazdan thermal power plants. Electricity savings in the utility sector come primarily from the use of variable speed electric drives and (as with gas-using equipment) upgrading of the existing capital stock.

Replacement of gas-fired equipment and use of energy efficient lighting offer the greatest savings. Together, these two measures account for roughly two-thirds of the money which can be saved through energy savings in Armenia. Most of the natural gas savings results from upgrading older gas-using equipment with more modern, energy efficient models or improving the thermal insulation in building heating systems. Roughly half of the electricity savings comes from using more energy efficient lamps. An additional 20 percent comes from installation of variable speed motors and replacement of equipment that uses electricity with more modern, efficient models.

Returns to most of the energy efficiency investments identified by the National Program are quite high with payback times of 3-7 years. Public sector investments have payback time of 2-4 years. The financial returns to investments in the utility and industrial sectors are lowest and the

payback time is longer, primarily because the capital expenditures required to earn these returns are relatively higher than in the other sectors.

The greatest returns are in the public sector. The organizational measures yield the highest return on investment in the public sector with near immediate payback. Installation of more energy efficient lighting, repair or replacement of valves in heat and water delivery systems within government buildings, and use of variable speed drives require an estimated capital investments of AMD 138 million and have payback period of 2-4 years. The highest returns in this sector are in public administration buildings with investment payback time of less than 2 years. The total investment costs required for realization of potential in the healthcare, social and education sectors is estimated at around AMD 2 billion. The healthcare, social services and education sectors have lower, but still very high positive returns and payback periods of 5-10 years.

Armenia, being in the economic blockade, which caused some obstacles for the primary energy supplying and imposed importing of high energy-saving technologies and their input in various branches of economy.

The “National Programme of the Republic of Armenia on Energy Saving and Renewable Energy” was adopted on 18 January 2007, by Protocol Decree No. 2 of the Government of the Republic of Armenia defines that 40% of national energy saving potential is in building sector. Building weatherization can save up to 30% thermal energy necessary for space heating equivalent to:

- 3.35 million GCal in residential buildings; and

- 0.67 million GCal in public/tertiary buildings.

- 15% energy reduction potential was identified in water supply and irrigation;
- Optimization of lighting was calculated to save 475 million kWh over the next 10 years;
- Industrial energy efficiency measures were estimated to reduce energy use:
  - By 5% in mining industries;
  - By 23% in chemical industry; and
  - By 35-40% in food industry.
- 210 MW new gas turbine installation and transition to fuel conservation mode would annually save Yerevan Thermal Power Plant (TPP) 265 million m<sup>3</sup> natural gas;
- Retrofitting of the fifth unit of Hrazdan TPP would annually save 223 million m<sup>3</sup> natural gas; etc.

Investment projects: WB-UHP, GEF/WB-EEP, EBRD-ArmSEFF, IFC-SEF

TA projects financed by GEF/UNDP, USAID, EBRD, etc

#### R2E2 Energy Efficiency Project

- Objective – Reduce energy consumption in public buildings
- Financing - Revolving Fund – \$8mln. from GoA to R2E2 Fund/GEF Grant - \$1,8mln.
- Beneficiaries – public and municipal agencies
- Typical ESMs – Insulation of walls and roofs, replacement windows, replacement of street lighting system

#### **4.1. Potential and drivers for Energy Efficiency and Energy Saving Improvements in Energy Supply:**

The annual energy saving potential of Armenian economy is estimated to be 1 million toe., of which about 16.5 % is the share of major economy sectors (excluding the expected installation of modern equipment in TPPs, thermal insulation of buildings, and modernization of vehicle fleet). Through implementation of thermal insulation, it will be possible to utilize

40% of the energy saving potential and with the installation of modern equipment in TPPs, this figure will increase to 43.4 %:

Assuming equal utilization of energy saving potential during the period of 2006-2020, and using the MAED software, 3 scenarios were analyzed:

- Pessimistic scenario with 30% utilization of energy saving potential
- Average scenario with 65% utilization of energy saving potential
- Optimistic scenario with 100% utilization of energy saving potential.

The GDP growth is presented the following way: 6% growth in 2006-2009, 5.5% in 2010, and

5 % in the year 2011-2020, according to the energy sector development strategy (Government decision from 23.06.2005).

During the calculation period (2006-2020) the fuel-energy consumption according to the aforementioned scenarios will be 48.2, 43.3 and 38.4 million toe, and the energy efficiency of GDP will accordingly be 1.042, 1.16 and 1.398 thousand AMD/kg oe, which means that compared to the year 2005 it will grow 1.09, 1.21, and 1.36 times correspondingly.

| <b>N</b> | <b>Energy saving targets</b>                                                                                                                        | <b>Energy saving potential</b> |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| 1        | Reduction of energy consumption through utilization of gravity flow of water and introduction of new technologies (in drinking water pump stations) | 15%                            |

|   |                                                                                                                                                            |                 |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 2 | Reduction of electricity consumption in 10-year period through introduction of energy efficient lamps in lighting systems                                  | 475 million kWh |
| 3 | Decrease of relative energy consumption in mining industry through application of energy efficient machinery (large flotation machines and stone-breakers) | 5%              |
| 4 | Increase of energy efficiency in chemical industry through improvement of technological procedures and equipment                                           | 23%             |
| 5 | Introduction of modern technologies and equipment in food industry                                                                                         | 35 - 40 %       |

#### 4.1.1. Energy Production

|   | <b>Energy saving targets</b>                                                                                                                                                                                                                                 | <b>Energy saving potential</b>                                          |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| 1 | Installation of new gas-turbine station with 210 MW capacity in Yerevan TPP which will result in fuel (natural gas) saving                                                                                                                                   | Around 184÷265 million m <sup>3</sup> of natural gas                    |
| 2 | Reconstruction of 5 <sup>th</sup> unit of Hrazdan TPP, which will result in fuel (natural gas) savings                                                                                                                                                       | Around 184÷265 million m <sup>3</sup> of natural gas                    |
| 3 | Efficient production of electric and thermal energy through introduction of small (under 50MW), high efficiency cogeneration units, and reduction of energy losses in distribution networks through deep penetration of energy generation in consumer sector | 223 million m <sup>3</sup> of natural gas                               |
| 4 | Application of renewable energy technologies through utilization of domestic resources, which will result in increased energy independence of the country                                                                                                    | 56 thousand tcf                                                         |
| 5 | Introduction of new, and reconstruction of existing, automatic control systems in electricity generation stations                                                                                                                                            | Up to 7%                                                                |
| 6 | Annual electricity and natural gas savings through application of efficient operation procedures in energy system                                                                                                                                            | Up to 120 million kWh or up to 24 million m <sup>3</sup> of natural gas |

#### 4.1.2 Energy Transportation, Energy Storage, Energy Distribution

|  | Energy saving targets                                                                                                                                                                                      | Energy saving potential                                |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
|  | Electricity savings through application of optimal procedures in 6-110 kV networks, improvement of transformers output and sources of compensating reactive power                                          | 26 million kWh                                         |
|  | Electricity savings through optimal division of 6-110 kV networks                                                                                                                                          | 15 million kWh                                         |
|  | Electricity savings through reduction of disparities of load schedule and introduction of double-tariff system                                                                                             | Around 17 million kWh                                  |
|  | Electricity savings through improvements of electricity network (construction of new substations, increase of wire section, construction of missing 0.38/0.22 kV wires, provision of symmetric load, etc.) | 32 million kWh                                         |
|  | Electric energy savings through increasing the load of power equipment                                                                                                                                     | Up to 3.1 million kWh                                  |
|  | Reduction of specific losses and increase of average load through application of flexible multilayer tariff system and leveling the daily load schedule in the network                                     | 3 million kWh                                          |
|  | Reduction of commercial losses through application of automatic control system for the whole commercial accounting system                                                                                  | Up to 1-2% (estimated saving is around 60 million kWh) |
|  | Electricity savings and reduction of substation triggering through improvement of relay protection and automatic control systems                                                                           | 12 million kWh                                         |

#### 4.2.Potential for Energy Efficiency and Energy Saving Improvements in Energy Consumption:

##### 4.2.1. Industry, Commercial and Public Services, Agriculture, Transportation, Residential Sector

| N | Energy Saving measures, by the sphere of activity                                                                       | Total energy saving potential |       |       |     |
|---|-------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------|-------|-----|
|   |                                                                                                                         | Natural volume                |       | toe   | %   |
|   |                                                                                                                         | Unit                          | Value |       |     |
| 1 | <b>Agriculture and provision of services (irrigation)</b>                                                               |                               |       |       |     |
|   | Elimination of failures and improvement of technological processes, organizational measures, decrease of idling process | MWh                           | 5,078 | 436.7 | 5.5 |

|              |                                                                                                                         |                     |        |                |             |
|--------------|-------------------------------------------------------------------------------------------------------------------------|---------------------|--------|----------------|-------------|
|              | Introduction of new energy efficient technological units and automation of electric drives                              | MWh                 | 12,506 | 1,075.3        | 13.6        |
|              | Utilization of gravity flow in irrigation systems                                                                       | MWh                 | 40,360 | 3,470.3        | 44.0        |
| <b>Total</b> |                                                                                                                         |                     |        | <b>4,982.3</b> | <b>58.9</b> |
| <b>2</b>     | <b>Metal ore extraction</b>                                                                                             |                     |        |                |             |
|              | Elimination of failures and improvement of technological processes, organizational measures, decrease of idling process | MWh                 | 12,986 | 1,116.6        | 3.5         |
|              | Introduction of new energy efficient technological units and automation of electric drives                              | MWh                 | 53,875 | 4,632.4        | 14.6        |
|              | Utilization of secondary energy resources                                                                               | MWh                 | 7,721  | 663.9          | 2.1         |
|              | Improvement of thermal insulation of furnaces and heating networks                                                      |                     | 2,843  | 2,529.6        | 11.5        |
|              | Use of energy efficient electric lamps                                                                                  | MWh                 | 381    | 32.7           | 0.1         |
| <b>Total</b> |                                                                                                                         |                     |        | <b>8,975.2</b> | <b>16.7</b> |
| <b>3</b>     | <b>Other branches of mining industry</b>                                                                                |                     |        |                |             |
|              | Improvement of thermal insulation of furnaces and heating networks                                                      | 1000 m <sup>3</sup> | 18     | 16.1           | 1.0         |
| <b>Total</b> |                                                                                                                         |                     |        | <b>16.1</b>    | <b>0.9</b>  |
| <b>4</b>     | <b>Food production (including beverages)</b>                                                                            |                     |        |                |             |
|              | Introduction of new energy efficient technological units and automation of electric drives                              | MWh                 | 25,400 | 2,184.0        | 23.3        |

| N | Energy Saving measures, by the sphere of activity                  | Total energy saving potential |       |         |      |
|---|--------------------------------------------------------------------|-------------------------------|-------|---------|------|
|   |                                                                    | Natural volume                |       | toe     | %    |
|   |                                                                    | Unit                          | Value |         |      |
|   | Improvement of thermal insulation of furnaces and heating networks | 1000m <sup>3</sup>            | 7,484 | 6,659.9 | 22.0 |

|              |                                                                                                                         |                    |        |                |             |
|--------------|-------------------------------------------------------------------------------------------------------------------------|--------------------|--------|----------------|-------------|
|              | Use of energy efficient electric lamps                                                                                  | MWh                | 11,058 | 950.8          | 10.1        |
| <b>Total</b> |                                                                                                                         |                    |        | <b>9,794.7</b> | <b>24.7</b> |
| <b>5.</b>    | <b>Tobacco production</b>                                                                                               |                    |        |                |             |
|              | Organizational measures                                                                                                 | MWh                | 1,307  | 112.4          | 1.0         |
|              | Introduction of new energy efficient technological units and automation of electric                                     | MWh                | 10,923 | 939.2          | 8.6         |
|              | Improvement of thermal insulation of furnaces and heating networks                                                      | 1000m <sup>3</sup> | 37     | 32.8           | 4.2         |
|              | Use of efficient fuel-energy resources                                                                                  | MWh                | 3,725  | 320.3          | 2.9         |
| <b>Total</b> |                                                                                                                         |                    |        | <b>1,404.7</b> | <b>12.0</b> |
| <b>6</b>     | <b>Textile production</b>                                                                                               |                    |        |                |             |
|              | Introduction of energy efficient motors and new control systems and options                                             | MWh                | 109    | 9.4            | 4.4         |
|              | Use of energy efficient electric lamps                                                                                  | MWh                | 457    | 39.3           | 18.5        |
| <b>Total</b> |                                                                                                                         |                    |        | <b>48.7</b>    | <b>10.8</b> |
| <b>7</b>     | <b>Publishing and printing industry</b>                                                                                 |                    |        |                |             |
|              | Use of energy efficient electric lamps                                                                                  | MWh                | 66     | 5.6            | 4.1         |
| <b>Total</b> |                                                                                                                         |                    |        | <b>5.6</b>     | <b>4.1</b>  |
| <b>8</b>     | <b>Chemical industry</b>                                                                                                |                    |        |                |             |
|              | Elimination of failures and improvement of technological processes, organizational measures, decrease of idling process | MWh                | 11,688 | 1,005          | 5.1         |

|              |                                                                                     |                                      |              |                |            |
|--------------|-------------------------------------------------------------------------------------|--------------------------------------|--------------|----------------|------------|
|              | Introduction of new energy efficient technological units and automation of electric | MWh                                  | 29,800       | 2,562.3        | 13.1       |
|              | Improvement of thermal insulation in energy stations                                | 1000m <sup>3</sup>                   | 3,203        | 2,850.3        | 4.4        |
|              | Utilization of secondary energy resources                                           | MWh                                  | 6,882        | 591.8          | 3.0        |
|              | Use of efficient fuel-energy resources                                              | MWh                                  | 4,150        | 356.8          | 1.8        |
|              | Use of energy efficient electric lamps                                              | MWh                                  | 213          | 18.3           | 0.1        |
| <b>Total</b> |                                                                                     |                                      |              | <b>7,384.5</b> | <b>8.7</b> |
| <b>9</b>     | <b>Production of rubber and plastic goods</b>                                       |                                      |              |                |            |
|              | Organizational measures                                                             | MWh                                  | 60           | 5.2            | 0.8        |
| <b>N</b>     | <b>Energy Saving measures, by the sphere of activity</b>                            | <b>Total energy saving potential</b> |              |                |            |
|              |                                                                                     | <b>Natural volume</b>                |              | <b>toe</b>     | <b>%</b>   |
|              |                                                                                     | <b>Unit</b>                          | <b>Value</b> |                |            |
|              | Introduction of new energy efficient technological units and motors                 | MWh                                  | 379          | 32.6           | 5.1        |
|              | Utilization of secondary energy resources                                           | MWh                                  | 78           | 6.7            | 1.0        |
|              | Improvement of thermal insulation in energy stations                                | 1000m <sup>3</sup>                   | 1.2          | 1.1            | 1.5        |
| <b>Total</b> |                                                                                     |                                      |              | <b>45.5</b>    | <b>6.4</b> |
| <b>10</b>    | <b>Other, non-metal ore extraction</b>                                              |                                      |              |                |            |
|              | Decrease of idling process and organizational measures                              | MWh                                  | 6,067        | 521.7          | 5.9        |

|              |                                                                                            |                    |        |                |             |
|--------------|--------------------------------------------------------------------------------------------|--------------------|--------|----------------|-------------|
|              | Introduction of new energy efficient technological units and automation of electric drives | MWh                | 22,003 | 1,891.9        | 21.5        |
|              | Improvement of thermal insulation of furnaces and heating networks                         | 1000m <sup>3</sup> | 5,952  | 5,296.6        | 3.5         |
|              | Reactive power compensation                                                                | MWh                | 1,051  | 90.4           | 1.0         |
|              | Introduction of new control systems and options                                            | MWh                | 3,314  | 285.0          | 3.2         |
|              | Use of energy efficient electric lamps                                                     | MWh                | 340    | 29.2           | 0.3         |
| <b>Total</b> |                                                                                            |                    |        | <b>8,114.8</b> | <b>5.1</b>  |
| <b>11</b>    | <b>Metallurgical industry</b>                                                              |                    |        |                |             |
|              | Decrease of idling process and organizational measures                                     | MWh                | 1,601  | 137.7          | 5.8         |
|              | Introduction of new energy efficient technological units and automation of electric        | MWh                | 2,677  | 230.2          | 9.7         |
|              | Improvement of thermal insulation of furnaces and heating networks                         | 1000m <sup>3</sup> | 4,047  | 3,601.4        | 11.2        |
|              | Application of diamond processing instruments                                              | MWh                | 2,678  | 230.3          | 9.7         |
|              | Use of efficient fuel-energy resources                                                     | MWh                | 253    | 21.8           | 0.9         |
|              | Use of energy efficient electric lamps                                                     | MWh                | 1,858  | 159.8          | 6.7         |
| <b>Total</b> |                                                                                            |                    |        | <b>4,381.1</b> | <b>12.7</b> |
| <b>12</b>    | <b>Production of ready-made metal products</b>                                             |                    |        |                |             |
|              | Introduction of new energy efficient technological units                                   | MWh                | 42     | 3.6            | 1.5         |

|              |                                                                                     |                                      |              |              |             |
|--------------|-------------------------------------------------------------------------------------|--------------------------------------|--------------|--------------|-------------|
|              | Improvement of thermal insulation of furnaces and heating networks                  | 1000m <sup>3</sup>                   | 25           | 21.8         | 2.0         |
| <b>Total</b> |                                                                                     |                                      |              | <b>25.4</b>  | <b>1.9</b>  |
| <b>13</b>    | <b>Production of machinery and equipment</b>                                        |                                      |              |              |             |
|              | Decrease of idling process and organizational                                       | MWh                                  | 317          | 27.2         | 2.5         |
| <b>N</b>     | <b>Energy Saving measures,<br/>by the sphere of activity</b>                        | <b>Total energy saving potential</b> |              |              |             |
|              |                                                                                     | <b>Natural volume</b>                |              | <b>toe</b>   | <b>%</b>    |
|              |                                                                                     | <b>Unit</b>                          | <b>Value</b> |              |             |
|              | Measures                                                                            |                                      |              |              |             |
|              | Introduction of new energy efficient technological units and automation of electric | MWh                                  | 840          | 72.2         | 6.6         |
|              | Application of diamond processing instruments                                       | MWh                                  | 1,128        | 97.0         | 8.8         |
| <b>Total</b> |                                                                                     |                                      |              | <b>196.4</b> | <b>9.8</b>  |
| <b>14</b>    | <b>Production of electrical machines and equipment</b>                              |                                      |              |              |             |
|              | Decrease of idling process and organizational measures                              | MWh                                  | 101          | 8.7          | 0.5         |
|              | Introduction of new energy efficient technological units and automation of electric | MWh                                  | 1,556        | 133.8        | 8           |
|              | Improvement of thermal insulation of furnaces and heating networks                  | 1000m <sup>3</sup>                   | 291          | 259          | 10.4        |
|              | Use of efficient fuel-energy resources                                              | MWh                                  | 365          | 31.4         | 1.9         |
|              | Application of diamond processing instruments                                       | MWh                                  | 471          | 40.5         | 2.4         |
|              | Use of energy efficient electric lamps                                              | MWh                                  | 2,283        | 196.3        | 11.7        |
| <b>Total</b> |                                                                                     |                                      |              | <b>669.6</b> | <b>16.0</b> |

|           |                                                                                                                         |                     |         |             |            |
|-----------|-------------------------------------------------------------------------------------------------------------------------|---------------------|---------|-------------|------------|
| <b>15</b> | <b>Production of radio, TV and communication equipment</b>                                                              |                     |         |             |            |
|           | Decrease of idling process and organizational measures                                                                  | MWh                 | 58      | 5           | 2.3        |
|           | Introduction of automatic metering for                                                                                  | MWh                 | 27      | 2.3         | 1.1        |
|           | <b>Total</b>                                                                                                            |                     |         | <b>7.4</b>  | <b>3.3</b> |
| <b>16</b> | <b>Other branches of industry</b>                                                                                       |                     |         |             |            |
|           | Introduction of new control systems and options                                                                         | MWh                 | 181     | 15.5        | 3.2        |
|           | Improvement of thermal insulation of furnaces and heating networks                                                      | 1000m <sup>3</sup>  | 5       | 4.2         | 3.0        |
|           | <b>Total</b>                                                                                                            |                     |         | <b>19.8</b> | <b>3.1</b> |
| <b>17</b> | <b>Production and distribution of electricity, natural gas, hot water and vapor</b>                                     |                     |         |             |            |
|           | Elimination of failures and improvement of technological processes, organizational measures, decrease of idling process | MWh                 | 24,972  | 2,147.2     | 9.1        |
|           | Introduction of new energy efficient technological units and automation of electric drives                              | MWh                 | 42,495  | 3,653.9     | 15.5       |
|           | Installation of gas turbine units in TPPs                                                                               | 1000 m <sup>3</sup> | 488,000 | 434,274.1   | 78.7       |
|           | Improvement of thermal insulation of furnaces and heating networks; decrease of losses in gas distribution system       | 1000 m <sup>3</sup> | 57,936  | 51,557.4    | 9.3        |

| N | Energy Saving measures, by the sphere of activity | Total energy saving potential |       |       |     |
|---|---------------------------------------------------|-------------------------------|-------|-------|-----|
|   |                                                   | Natural volume                |       | toe   | %   |
|   |                                                   | Unit                          | Value |       |     |
|   | Improvement of thermal insulation                 | 1000 m <sup>3</sup>           | 141   | 125.2 | 4.9 |

|              |                                                          |     |        |                |             |
|--------------|----------------------------------------------------------|-----|--------|----------------|-------------|
|              | Use of energy efficient electric lamps                   | MWh | 1,049  | 90.2           | 8.2         |
| <b>Total</b> |                                                          |     |        | <b>237.5</b>   | <b>6.5</b>  |
| <b>23</b>    | <b>Ground transportation</b>                             |     |        |                |             |
|              | Decrease of idling process                               | MWh | 1,658  | 142.6          | 1.7         |
|              | Introduction of new energy efficient technological units | MWh | 4,067  | 349.7          | 4.2         |
| <b>Total</b> |                                                          |     |        | <b>492.3</b>   | <b>5.8</b>  |
| <b>24</b>    | <b>Air transportation</b>                                |     |        |                |             |
| <b>25</b>    | <b>Communication</b>                                     |     |        |                |             |
|              | Organizational measures                                  | MWh | 1,393  | 119.8          | 2           |
|              | Introduction of new energy efficient technological units | MWh | 15,200 | 1,307          | 22.1        |
|              | Use of energy efficient electric lamps                   | MWh | 7,276  | 625.6          | 10.6        |
| <b>Total</b> |                                                          |     |        | <b>2,052.4</b> | <b>32.7</b> |
| <b>26</b>    | <b>Financial intermediation</b>                          |     |        |                |             |
| <b>27</b>    | <b>Real estate operations</b>                            |     |        |                |             |
| <b>28</b>    | <b>Research and development</b>                          |     |        |                |             |
| <b>29</b>    | <b>State governance</b>                                  |     |        |                |             |
|              | Decrease of idling process                               | MWh | 1,685  | 144.9          | 1           |
|              | Introduction of new energy efficient technological units | MWh | 8,801  | 756.8          | 5.2         |
|              | Use of energy efficient electric lamps                   | MWh | 8,778  | 754.7          | 5.2         |
| <b>Total</b> |                                                          |     |        | <b>1,656.4</b> | <b>8.2</b>  |

|           |                                                    |                     |       |              |            |
|-----------|----------------------------------------------------|---------------------|-------|--------------|------------|
| <b>30</b> | <b>Education</b>                                   |                     |       |              |            |
|           | Improvement of thermal insulation                  | 1000 m <sup>3</sup> | 373   | 331.6        | 6.1        |
|           | Valve system improvement                           | MWh                 | 171   | 14.7         | 2.9        |
|           | <b>Total</b>                                       |                     |       | <b>346.3</b> | <b>5.8</b> |
| <b>31</b> | <b>Healthcare and provision of social services</b> |                     |       |              |            |
|           | Decrease of idling process                         | MWh                 | 2,701 | 232.3        | 4.6        |
|           | Automation of electric drives                      | MWh                 | 3,174 | 272.9        | 5.4        |
|           | Improvement of thermal insulation                  | 1000 m <sup>3</sup> | 2,380 | 2,118.2      | 28         |

| N         | Energy Saving measures,<br>by the sphere of activity | Total energy saving potential |         |                 |             |
|-----------|------------------------------------------------------|-------------------------------|---------|-----------------|-------------|
|           |                                                      | Natural volume                |         | toe             | %           |
|           |                                                      | Unit                          | Value   |                 |             |
|           | Use of energy efficient electric lamps               | MWh                           | 2,819   | 242.4           | 4.8         |
|           | Valve system improvement                             | MWh                           | 1,101   | 94.6            | 1.9         |
|           | Use of efficient fuel-energy resources               | MWh                           | 2,349   | 202             | 4           |
|           | <b>Total</b>                                         |                               |         | <b>3,162.4</b>  | <b>25.1</b> |
| <b>32</b> | <b>Activities of social units</b>                    |                               |         |                 |             |
|           | Decrease of idling process                           | MWh                           | 13,721  | 1,179.8         | 2           |
|           | Automation of electric drives                        | MWh                           | 24,269  | 2,086.7         | 3.5         |
|           | Use of energy efficient electric lamps               | MWh                           | 135,524 | 11,653          | 19.6        |
|           | <b>Total</b>                                         |                               |         | <b>14,919.5</b> | <b>15.9</b> |
| <b>33</b> | <b>Residential sector</b>                            |                               |         |                 |             |
|           | Use of energy efficient electric lamps               | MWh                           | 302,946 | 26,048.6        | 21          |
|           | <b>Total</b>                                         |                               |         | <b>26,048.6</b> | <b>6.5</b>  |

|           |                                           |                           |                  |                |               |
|-----------|-------------------------------------------|---------------------------|------------------|----------------|---------------|
| <b>34</b> | <b>Leisure and cultural activities</b>    |                           |                  |                |               |
|           | Valve system improvement                  | MWh                       | 128              | 11             | 1             |
|           | Use of efficient fuel-energy resources    | MWh                       | 378              | 32.5           | 3.1           |
|           | <b>Total</b>                              |                           |                  | <b>43.5</b>    | <b>2.7</b>    |
| <b>35</b> | <b>Foreign companies activities</b>       |                           |                  |                |               |
|           | <b>TOTAL: ELECTRICITY</b>                 | <b>MWh</b>                | <b>1,035,658</b> | <b>89,051</b>  | <b>5.4168</b> |
|           | <b>TOTAL: NATURAL GAS</b>                 | <b>1000 m<sup>3</sup></b> | <b>572,734</b>   | <b>509,679</b> | <b>31.003</b> |
|           | <b>TOTAL IN ALL SPHERES OF ACTIVITIES</b> |                           |                  | <b>598,730</b> | <b>36.4</b>   |

## 5. Barriers and Challenges to Energy Efficiency and Energy Saving Improvements and to Mutual Cooperation

Challenges:

- Voluntary nature of the provisions of Law on Energy Efficiency and Renewable Energy
- Lack of secondary legislation
- Lack of awareness

Opportunity:

- Support by development partners

### 5.1. Economic and Financial

Of the possible universe of energy efficiency investments with technical potential, only some will be financially and economically viable. The difference between economically and financially viable investments is modeled by differentiating between: i) the opportunity cost of capital used for public and private investors, ii) the inclusion of indirect benefits of energy savings, and iii) the inclusion of externalities.

Economically and financially viable energy efficiency investments are those investments with technical potential which also yield a positive return on investment for Armenian society as a whole, for private investors (companies, organizations or individuals), or both. Economically viable projects yield a positive return on investment for Armenia as a whole, and hence for the government as a “public investor”, but not necessarily for private investors, companies or organizations. Financially viable projects yield a positive return for the private investors who make those investments.

Economically and financially viable investments are identified from the pool of technically viable investments by comparing the cost of an energy efficiency investment to the value of that investment. The “cost of saved energy” (CSE) approach is used to determine the cost of the energy efficiency investment. The costs of an energy efficiency investment

include: i) the incremental capital cost of the energy efficiency investment, and ii) any additional costs or benefits of the energy efficiency investment.

## **5.2. Legal, Institutional and Administrative**

Several barriers prevent energy efficiency investments in specific sectors. More specifically:

- **Public administration.** Although the budgeting laws allow the public administration bodies to reallocate energy savings, they are not adequately flexible to allow for sufficient incentives to save on energy costs.
- **Residential.** Much of the energy inefficiency in buildings is due to poor insulation of common spaces. Apartment owners are reluctant to commit to investments in these spaces because of the risk that other residents may get a free ride on that investment.
- **Utilities.** Energy utilities have an incentive to sell, rather than conserve energy.

## **5.3. Lack of Awareness, Human Capacities and Professional Skills**

Lack of information about the benefits of energy efficiency investments impedes realization of the existing economically and financially viable potential. Armenian consumers lack information on the efficiency of different types of equipment available to their households, and many industrial companies lack the internal expertise and skills necessary to create an energy efficiency investment plan. Consumers and private companies tend to systematically overestimate the costs of energy efficiency investments. The National Program provides a solid foundation for estimating Armenia's energy efficiency potential and using that potential to inform policy. However, the National Program lacks detailed estimates of how to improve energy efficiency in Armenia's two largest energy consuming sectors: transport and heating in buildings.

Energy utility regulation in Armenia (as in many countries) encourages utilities to sell as much as they can to recover their fixed costs, and encourages investment in new production capacity, rather than measures to reduce load.

## **6. Recommendations and Proposals on Creating a More Favorable Climate for Energy Efficiency and Energy Saving Improvements, on Enhancing Sub-Regional Cooperation between the CIS Countries to Foster Synergies**

Armenia can improve energy efficiency by implementing and enforcing its existing legal and regulatory framework, and designating an energy efficiency "champion", directly mandating and investing in public sector energy efficiency, improving data collection, considering limited fiscal incentives for the private sector, and changing tariff regulation to encourage better energy

efficiency at the utility and end-use levels.

Implement Armenia's energy efficiency legislation; appoint an energy efficiency "champion"

The Government's ongoing effort to adopt energy efficiency standards needs to be accelerated, and once adopted, the standards must be enforced. An energy efficiency "champion" agency can help accelerate this process, and the agency needs to have support and participation from a variety of sectors within government. The Renewable Resources and Energy Efficiency Fund (R2E2) is a reasonable choice for such an agency. The Fund's Board of Trustees includes Ministers or Deputy Ministers from a wide range of sectors, and its staff has developed expertise in driving energy efficiency policy and implementing a wide range of energy efficiency programs in the country.

An energy efficiency agency can play a critical role in developing and implementing the following measures, often deemed necessary in removing critical barriers to energy efficiency: (i) developing energy efficiency standards; (ii) conducting certification and labeling; (iii) certifying and/or licensing energy auditors; (iv) developing short-term and long-term energy efficiency programs; (v) coordinating the energy efficiency activities in different branches of economy; (vi) disseminating information; (vii) promoting education/awareness of energy efficiency; (viii) funding pilots and demonstrations; (ix) providing technical assistance; (x) providing financial incentives; and (xi) initiating collaboration/partnerships.

Mandate energy efficiency in public administration

The Government can require its agencies to improve energy efficiency by:

- Setting agency-wide or sector-wide energy efficiency targets
- Benchmarking public agency performance in improving energy efficiency
- Setting energy efficiency standards specific to public agencies, including procurement rules which favor more energy efficient products
- In the interest of promoting the nascent market for firms that provide ESCO-like functions, encourage public agencies to enter into multi-year contracts with private companies

Information campaign

The Government should consider designing and implementing information campaigns to inform the households, private sector, the public institutions and public administration bodies about the

benefits of investments in energy efficiency.

#### Improve data collection

As described above, the National Program is currently the single most comprehensive study of energy use and energy efficiency potential in Armenia. The foundation of the National Program needs to be expanded to include detailed surveys of energy use and energy efficiency potential in heating buildings and transportation. Mechanisms must also be put in place to ensure that the National Program can be regularly updated. The Government should proceed to design a set of templates and procedures which ensure the National Program data set can be updated annually and expanded over time.

Investigate further and invest in energy saving measures for public sector entities.

The Government should consider making investments in improving energy efficiency in the public sector. Making such investments will save energy and money for the Government while sending a clear message to the private sector and individual consumers that the Government is dedicated to promoting and investing in energy efficiency. To begin with, the Government should consider investing in energy efficiency lighting, variable speed drives, and repair or replacing of valves in building heating and water systems in public administration, health and social buildings.

Provide support for demonstration/pilot projects in the private sector

Fiscal incentives are a reasonable policy tool to encourage energy efficiency in the private sector if they are used to subsidize capital investments that are not being made because of specific market failures (for example, negative environmental externalities not being reflected in energy prices), to provide a public good (for example, providing information on the return to energy efficiency investments through demonstration projects). In Armenia, therefore, the Government may consider providing one-off, limited capital subsidies or loan guarantees for demonstration or pilot projects in the residential or industrial sectors. The R2E2 Fund's on-lending program under the World Bank financed Urban Heating Project provides an excellent example of how a one-time injection of capital can trigger private sector investment in energy efficiency.

Organization of public outreach and wide informational-educational work of mass media play a significant role in development of energy saving and renewable energy overcoming the market entry barrier for efficient technologies, equipment and materials, providing information to the public on supply and demand, and developing a of positive public opinion.

- 1) Main purpose of informational-educational work:
  - a) Media coverage of responses received from the state and local government bodies, as well as from public and commercial organizations on the energy saving and renewable energy development issues,
  - b) Media coverage of state policy and implementation mechanisms,
  - c) Formation of public opinion on implementation of specific measures,
  - d) Educational and advertisement activities.
- 2) In order to achieve aforementioned goals it is necessary to solve the following issues:
  - a) Continuous analysis of public opinion and the socio-psychological environment,
  - b) Continuous analysis of international experience, available technologies, equipment, and materials in the field for energy saving and development of renewable energy resources,
  - c) Analysis of results acquired from implementation of energy saving measures and development of renewable energy resources projects, taking into consideration market trends on the technologies, equipment and materials,
  - d) Formation of positive public opinion on price formation and modernization issues in the field of energy saving and renewable energy resource development,
  - e) Dissemination of information on legal basis and opportunities on implementation of energy saving and renewable energy resource development projects, as well as their results, to the general public.

In order to achieve the aforementioned goals it is necessary to involve mass media (newspapers, magazines, radio, television), as well as publish and disseminate in general public booklets, brochures and leaflets, that will ensure the public nature of the proposed goals.

- 3) Funding sources for the proposed informational-educational work include:
  - a) USAID, EU and other technical assistance programs,
  - b) Special expenditure lines in loans received from international financial institutions,
  - c) Grants from the State Budget, humanitarian programs, etc.
  - d) Allocations from the Energy Saving and Renewable Energy Fund,
  - e) Other sources.

4) Methodology of the informational-educational work is based on:  
Operative work

- a) Analysis of critique and advices received from the publications, messages and mass media,
- b) Analysis of market trends, the demand and supply indices,
- c) Analysis of public opinion,
- d) Media coverage of operative information from mass media programs and other projects.

Media coverage

- e) Organization of international and national scientific and practical educational seminars and congresses,
- f) Organization and participation in international exhibitions,
- g) Media coverage of international news on energy saving and renewable energy development,
- h) Media coverage of state policy in the sphere of energy saving and renewable energy development, the goals of this Program, and the public opinion,
- i) Media coverage of ecological issues of energy saving,
- j) Media coverage of results achieved in certain projects,
  - i) Promotion of affordable technologies, equipment and materials in domestic markets,
  - ii) Promotion of efficiency of projects available for the public (energy efficient lamps, domestic equipment, thermal insulation of apartments, etc),
  - iii) Awareness raising activities,
  - iv) Implementation of pilot projects in the sphere of energy saving and renewable energy development, and their promotion,
  - v) Publishing of annual reports on energy saving and renewable energy development of stakeholder ministries and other state bodies,
  - vi) Production and dissemination of video clips on technologies, equipment and materials available in domestic market,
  - vii) Establishment of internet site devoted to energy saving and renewable energy development, providing an interactive communication option with the visitors, production of informational materials for children “Energy Saving for Children”
  - viii) Provision of affordable coverage on issues and trends in energy saving and renewable energy development to the broad public; publishing and free

distribution of brochures, booklets and notes, as well as special literature for kids on energy saving and renewable energy, etc.

The preparation of specialists in the field of energy saving will be targeted to implementation and development of tasks mentioned in the Article 10 of the law on Energy Saving and Renewable Energy of Armenia.

It is proposed to develop a multi-level educational system in the field of energy saving for preparation of specialists, with an open education system approach.

1) Improvement of manpower development mechanism:

- a) Development of Energy Efficient Technologies and Energy Management subject in the department of Energy of the State Engineering University of Armenia,
- b) Development and improvement of educational material on energy efficient buildings and constructions for the faculty of the Yerevan State Architectural University,
- c) Development of educational system in renewable energy field,
- d) Development of educational system in environmental field (for energy specialists),
- e) Development and improvement of educational programs, laboratory practices, and trainings for specialists,
- f) Increase of proficiency of energy saving specialists in different spheres of economy and different social environments,
- g) Establishment and modernization of energy examination certified testing laboratories,
- h) Organization of seminars and congresses on energy saving, renewable energy and environmental issues,
- i) Organization of educational programs for national specialists abroad,
- j) Introduction of new subjects on energy saving, renewable energy and environmental issues in schools,
- k) Organization of open classes on energy saving, renewable energy and environmental issues,
- l) Introduction of elective courses on energy saving, renewable energy and environmental issues in educational systems,

m) Organization of educational trips to energy objects,

n) Organization of Marz and city-level competitions in the field of energy saving, renewable energy and environment protection, etc.

## **7. Conclusion**

Armenia is already one of the best examples among the former Soviet Republics, but considerably worse than its European peers. Armenia owes some of its success in improving energy efficiency to necessity: Unlike some of its hydrocarbon-rich neighbors, Armenia imports nearly all of its hydrocarbon fuels, and therefore has had to promote reforms to improve the economic efficiency of the sector in order to survive.

However, at least some of Armenia's apparent energy efficiency is attributable to the disappearance of heavy industry, as the industrial collapse in Armenia after Independence was much more severe than in other former Soviet Republics.

Armenia can improve energy efficiency by implementing its existing legal and regulatory framework, and designating an energy efficiency "champion", directly mandating and investing in public sector energy efficiency, improving data collection, considering limited fiscal incentives for the private sector, and changing tariff regulation to encourage better energy efficiency at the utility and end-use levels. The Government should consider designing and implementing information campaigns to inform the households, private sector, the public institutions and public administration bodies about the benefits of investments in energy efficiency. As described above, the National Program is currently the single most comprehensive study of energy use and energy efficiency potential in Armenia. The foundation of the National Program needs be expanded to include detailed surveys of energy use and energy efficiency potential in heating buildings and transportation. Mechanisms must also be put in place to ensure that the National Program can be regularly updated. It should be proceed to design a set of templates and procedures which ensure the National Program data set can be updated annually and expanded over time. It should be considered making investments in improving energy efficiency in the public sector. Making such investments will save energy and money for the Government while sending a clear message to the private sector and individual consumers that the Government is dedicated to promoting and investing in energy efficiency. To begin with, it should be considered investing invest in energy efficiency lighting, variable speed drives, and repair or replacing of valves in building heating and water systems in public administration, health and social buildings. Fiscal incentives are a reasonable policy tool to encourage energy efficiency in the private sector if they are used to subsidize capital investments that are not being made because of specific market failures (for example, negative environmental externalities not being reflected in energy prices), to provide a public good (for example, providing information on the return to energy efficiency investments through demonstration projects). In Armenia, therefore, it may be considered providing one-off, limited capital subsidies or loan guarantees for demonstration or pilot projects in the residential or industrial sectors.

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