FIX
ENERGY FINANCING MIX

Armenia

Energy Policy Baseline

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1. INTRODUCTION

This report is part of the baseline analysis of the E-FIX project. The E-FIX project aims at triggering private finance for sustainable energy projects using innovative financing mechanisms. In the target countries of Central and South Eastern Europe as well as the countries of the Caucasus region there is considerable idle potential for sustainable energy products and services. Both potential energy project developers and financers face diverse financing barriers. An innovative energy financing mix is needed in order to activate new source of finance and facilitate an increased implementation of sustainable energy projects. Accordingly, the objective of the E-FIX project is to facilitate the take up and intensified usage of innovative energy financing mechanisms in the energy sector.

This report provides the first analysis of the regulatory environment in which energy projects are implemented in each of the focus countries. With this part of the baseline study the E-FIX experts conduct an assessment of the energy-related policy framework in order to identify opportunities and challenges for introducing innovative financing instruments for sustainable energy projects. The material will be part of the subsequent Gap Analysis combining financing and energy baseline data.

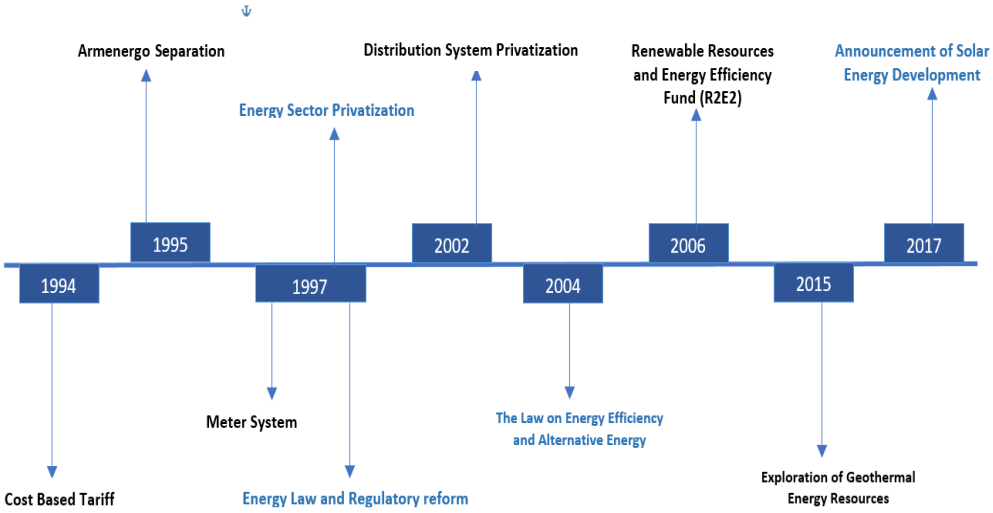
The present report describes the energy policy framework for Armenia.

2. POLICY FRAMEWORK

2.1. OVERVIEW OF LEGAL FRAMEWORK AND POLICY DEVELOPMENT OF THE ENERGY SECTOR IN ARMENIA

Armenia's energy sector has experienced several changes since the collapse of the Soviet Union. Economic degradation and external conflicts throughout the 90's influenced the transformation of the energy sector from the vertically integrated into market-based structure. The restructuring process was largely based on the privatization of assets and development of a new regulatory framework. Major developments in Armenia's energy sector are presented in the timeline below[1].

Figure 1 Development of Armenian Energy Market



1994 - A key focus area of the reform program was the gradual transition towards cost-based tariffs. This has resulted in higher consumer prices per unit and reduced consumption accordingly.

1995 - The dissembling process of state owned and vertically integrated company Armenergo influenced the creation of separate generating, transmitting and distributing entities.

1997 - The Energy Law separated and assigned the generating, distributing, transmission and dispatch functions to different companies, whilst also establishing an independent sector regulator; the Public Services Regulating Commission (PSRC). 25 small hydropower plants have been privatized between 1997 and 2002. Between 1997 and 1998, the power system was equipped with 12,000 tamper-proof meters.

2002 – Electric Networks of Armenia were acquired by Midland Resources Holding (part of Midland Group - privately owned company registered in Guernsey in the UK's Channel Islands), which helped stimulate privatization in the generation sector. Russian companies took ownership of the Hrazdan thermal power plant, the Sevan-Hrazdan hydropower cascade and financial control of Armenian Nuclear Power Plant.

[1] http://siteresources.worldbank.org/INTARMENIA/Resources/Armenia-power-sector-reform.pdf

2004 – Public Services Regulating Commission adopted feed-in tariffs (FIT) for small hydro power plants. FITs were denominated in USD for 15 years of operation. Also, the Parliament of Armenia has adopted The Law on Energy Efficiency and Renewable energy to promote the use of renewable energy and increase the country's energy independence and security.

2007 - The adoption of the FITs in 2004 resulted in the dramatic growth of the Small hydro power plants and PSRC has decided to review the FIT scheme to reflect market conditions. Particularly, starting from 2007 the tariffs are denominated in AMD with the annual adjustment based on inflation (CPI) and AMD/USD exchange rate.

2015 - The exploration of geothermal energy resources in Karkar has been implemented within the framework of the renewable energy deployment strategy.

2016 - Adoption of the net metering scheme for small PV installations (less than 100 kV), which have boosted small scale solar power development in Armenia.

2017-2018 Ministry of Energy has announced about new strategy for the promotion of solar energy in Armenia. PSRC has auctioned 10 licenses with the total capacity 10 MW for photovoltaic installations. The Armenian ministry of energy announced the tender for the construction of Masrik PV station with of 55 MW capacity. The contract has been awarded to consortium Fotowatio Renewable Ventures and F.S.L. Solar.

Armenia's first policy document "Energy Sector Development Strategies in the Context of Economic Development in Armenia[2]" was adopted in 2005. The core element of the strategy includes ensuring a reasonable level of the nation's energy security. Armenia has overcome the grave energy crisis and has learned the lessons of poor energy security. The energy security strategy is based on the implementation of a three-tier diversification that envisions:

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

The policy document sets out directions that address the priorities and development opportunities in energy sector of the country and also main directions towards energy security. The policy intends to develop a long-term comprehensive state vision, which will become the basis for the development of short, medium and long term strategies for 2030. Energy policy document covers the following areas:

- Achieving sustainable economic development in Armenia;
- Ensuring safety in the energy sector;
- Enhancing the energy independence of the country, including diversification of imported and domestic energy resources and ensuring maximum utilization of generating capacity;
- Ensuring efficient use of domestic energy resources and alternative sources of energy and implementation of economic and legal mechanisms for that purpose.

The Armenian Development Strategy (ADS) and National Security Strategy (NSS) also emphasize the importance of renewable energy and energy efficiency in addressing energy security. The ADS and NSS outline the strategic objectives for economic growth, poverty reduction and national security. Both policies

[2] http://www.nature-ic.am/wp-content/uploads/2013/10/Energy-Strategy-Final-Eng.pdf

highlight the fundamental importance of the energy sector in achieving these objectives. The strategic objectives of the ADS and NSS for the energy sector include:

- Increase of energy security and development of renewable energy, including increased efficiency of existing hydropower potential and creation of alternative sources of energy supply
- Improvement of system reliability
- Development of regional trade
- Replacement of depreciated power plants
- Promotion of energy efficiency
- Further development of nuclear energy

Several energy sector strategic documents specify targets for achieving the GoA's stated objectives in the sector: (i) Energy Sector Development Strategy within the Context of the Economic Development in Armenia, approved by the GoA in 2005, (ii) The National Programme on Energy Saving and Renewable Energy, approved in 2007, and (iii) The Action Plan of the MENR of the Republic of Armenia in line with the National Security Strategy, approved in 2007. The key principle of the energy strategy adopted by the Armenian Energy Ministry included ensuring sustainable development of the energy sector based on the prevailing economic trends. It sought to expand regional cooperation prospects, taking into account the experience gained by the energy sector.

Armenia ratified Energy Charter Treaty (ECT) in 1997, which entered into force in 1998 and the Protocol on Energy Efficiency and Related Environmental Aspects (PEEREA) in 1994[3]. By ratifying PEEREA, countries commit to formulating strategies and implementing policies for improving energy efficiency and reducing negative environmental impacts of the energy cycle[4]. One of the principles of the Protocol is that contracting parties have to cooperate and assist each other in development of energy efficiency policies and appropriate legal and regulatory framework in order to reduce barriers to energy efficiency, to improve mechanisms for EE financing and public awareness.[5]

The Republic of Armenia ratified the UN Framework Convention on Climate Change in May 1993, and the Kyoto Protocol in December 2002. Armenia as a Non-Annex I Party to the Convention, and is regularly implementing obligations pursuant to its status.

In the framework of the Government's efforts for climate change mitigation, the importance of EE has increased. After Government ratified the UNFCCC in 1994 and accessed the Kyoto Protocol in 1999, several efforts and projects have been implemented since 2003, including[6]:

- Increase in energy production based on renewable energy sources
- Modernization of the thermal power plants
- Improvement of energy efficiency in all sectors of the economy
- Improvement of energy efficiency in buildings and constructions
- Decrease of loss in methane flow in gas transportation and gas delivery system
- Expansion of electrical transport and increase of the natural gas share in motor transport's fuel
- Decrease in methane emissions from solid municipal waste and waste water\

[3] https://energycharter.org/who-we-are/members-observers/countries/armenia/
[4] Article 5, PEEREA: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:21994A1231(53)&from=EN
[5] Article 3, PEEREA: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:21994A1231(53)&from=EN
[6] www.nature-ic.am

- Restoration of degraded forests, afforestation and reducing the volumes of deforestation, sustaining soil CO_2 content and ensuring its increase

On November 24, Armenia and the EU officially signed the Comprehensive and Enhanced Partnership Agreement (CEPA). For Armenia, signing CEPA marks a substantial step toward developing western democratic reforms. The agreement bolstered bilateral relations between the two governments, opening a path to expand economic activity. In return, Armenia has agreed upon fundamental goals that are in the financial, political, and moral interest of the Armenian people.

Although there is a realisation on the part of Armenia that the EU directives related to the energy efficiency and environment have serious budgetary implications, CEPA is very ambitious as far as energy efficiency, environment and climate change are concerned. Armenia kept most of the environmental and climate action acquis of its draft Association Agreement, while in some cases slightly extending timetable of the implementation. This includes directives concerning environmental governance, water (e.g. Directive 91/676/EC), air (Directive 2008/50/EC), industrial emissions (Directive 2010/75/EU), waste management (Directive 2008/98/EC), hazards and dangerous substances (Directive 96/82/EC) and chemicals and nature protection (Directive 2009/147/EC). EU and Armenia agreed to cooperate on energy matters on the basis of the principles of partnership, mutual interest, transparency and predictability.

Cooperation shall aim at regulatory harmonisation in the areas of the energy sector, taking into account the need to ensure access to secure, environmentally friendly and affordable energy.

The cooperation will cover the following areas:

- energy strategies and policies, including for the promotion of energy security and diversity of energy supplies and power generation
- the enhancement of energy security, including by stimulating the diversification of energy sources and routes
- the development of competitive energy markets
- the promotion of the use of renewable energy sources, energy efficiency and energy savings the promotion of regional cooperation on energy and on integration into regional markets
- pricing policies, transit and transport, in particular a general cost-based system for the transmission of energy resources, if and when appropriate, and further precisions regarding access to hydrocarbons, as appropriate;
- scientific and technical cooperation, including the exchange of information for the development and improvement of technologies in energy production, transportation, supply and end use with particular attention to energy-efficient and environmentally friendly technologies.

The primary government bodies responsible of energy efficiency for the building sector are the Ministry of Urban Development (MUD), the Ministry of Energy and Natural Resources (MENR) and the Public Service Regulatory Commission (PSRC).

There is no single piece of legislation addressing the energy efficiency matters in buildings, but rather a set of legislative or regulatory documents referring to energy efficiency in all sectors of the economy.

Armenia's primary legislation in the field of Energy consists of the two main laws:

- The Law of the Republic of Armenia on Energy" (2001)
- Law on Energy Saving and Renewable Energy (2004).

These two laws define the main principles of the state policy in the energy sector.

Secondary legislation comprises different statutory acts, like president and government decrees and regulations, ministerial orders and the PSRC (Public Services Regulating Commission) resolutions. Several important primary and secondary legal acts are as follows:

- RA Presidential Decree NK-182-N "On Approving the Energy Security Concept of the Republic of Armenia, 23 October, 2013
- RA Government Decision N 836-N "On Approving the Program- Timeline of 2014-2020 of Measures Securing the Implementation of the Provisions of Energy Security Provision Concept of the Republic of Armenia", 31 July, 2014
- RA Governmental Decision N 1399-N "On Establishing Procedure of Energy Audit and Making Amendments in the RA Governmental Decree N 2200-N dated December 09, 2005", 31 August, 2006
- RA Government Decision 1504–N "On Implementation of Energy Saving and Energy Efficiency Improvement Measures in Facilities Being Constructed (Reconstructed, Renovated) Under the State Funding", 25 December 2014
- RA Government Decision N1294-N "On Establishing "The Staff of the Ministry of Urban Development of the Republic of Armenia" Institution, Approving the Charter and Structure of the Ministry of Urban Development of the Republic of Armenia" 25 July, 2002
- RA Government Decision N 1481-A "On Approving the Combined list of Legal Acts Subject to Harmonization in the Energy Sector as Envisaged by the Draft EU-RA Association Agreement", 22 November, 2012
- RA Government Decision N 511-A "On the Program of the Government of Republic of Armenia", 19 May, 2014
- RA Government Protocol Decision N24 "On Adopting the Energy Sector Development Strategy in the Context of Economic Development of Armenia", 23 June, 200526
- RA Government Protocol Decision N2 "On Approving the National Program on Energy Saving and Renewable Energy", 18 January, 2007
- RA Government Protocol Decision N43 "On Adopting the Action Plan of the Government of the Republic of Armenia for Implementation of the National Program on Energy Saving and Renewable Energy of the Republic of Armenia", 4 November, 2010
- Order N93-N of the Minister of Urban Development, RABN 31-01-2014 "Residential buildings: Part I: Multi-apartment residential buildings"

2.2. EXISTING NATIONAL AND REGIONAL LAWS AND STANDARDS

Two main laws currently regulating energy efficiency in the country are: „*The Law of the Republic of Armenia on Energy"* dated April 11, 2001 and *Law on Energy Saving and Renewable Energy.* These two laws define the main principles of the state policy in the energy sector. In particular, T*he Law of the Republic of Armenia on Energy defines the main principles of the state policy in the energy sector:*

- Enhancement of competition and efficient operation in the energy sector
- Regulation of energy sector operations
- Protection and balance of interests between consumers and economic entities
- Efficient use of domestic and alternative sources of energy, and the creation of economic and legal mechanisms to serve that purpose
- Encouragement of investments, safety and environmental protection in the energy sector

- Encouragement of scientific and technical progress and employment of new energy efficient and energy-saving technologies, as well as encouragement of personnel training and retraining
- Separation of the generation, transmission and distribution system operators, etc.

The "Law on Energy Saving and Renewable Energy", regulates the inter-relations of the state administration and local self-government bodies of the Republic of Armenia, legal and physical persons arising from and in connection with the activities in the sphere of energy saving and renewable energy. As stated in Article 5, the state policy in the area of energy saving and renewable energy is based on the *principle of voluntary participation* of the involved parties. The chapter 3 regulates the matters regarding energy auditing. According to the point 2 of article 13, the energy examination/audit of buildings is voluntary and carried out by the initiative and at the expense of legal and physical persons.

The Law stipulates that state policy in the area of energy saving and renewable energy shall be based on the principle of voluntary participation of the involved parties, and the following principles:

- Increasing the level of supply of indigenous renewable energy carriers to satisfy the energy demand of the economy
- Implementation of energy-saving strategies, as well as the development and enforcement of legal and economic mechanisms for the promotion of renewable energy
- Ensuring high priority of efficient use of energy given the increasing volumes of imported and extracted energy resources
- Ensuring increasing usage of renewable energy resources as well as the application and development of new renewable energy technologies
- Ensuring competitiveness of renewable energy resources and protection/enforcement of the rights of businesses engaged in the area of renewable energy
- Ensuring high priority of issues of environmental protection and efficient (economic) usage of natural resources while implementing measures/activities aimed at the development of energy saving and renewable energy
- Promotion of energy-efficient production of electric and/or heat energy, including for autonomous energy producers
- Promotion of integrated activities between autonomous energy producers, using renewable energy resources, and the energy system aimed at the exchange of electric energy
- Promotion of consumer choices and use of different energy carriers and energy efficiency technologies; and
- Implementation of energy-saving and renewable energy state (national)-targeted programs.

In 2016, changes to the Law on Energy Saving and Renewable Energy were introduced as follows:

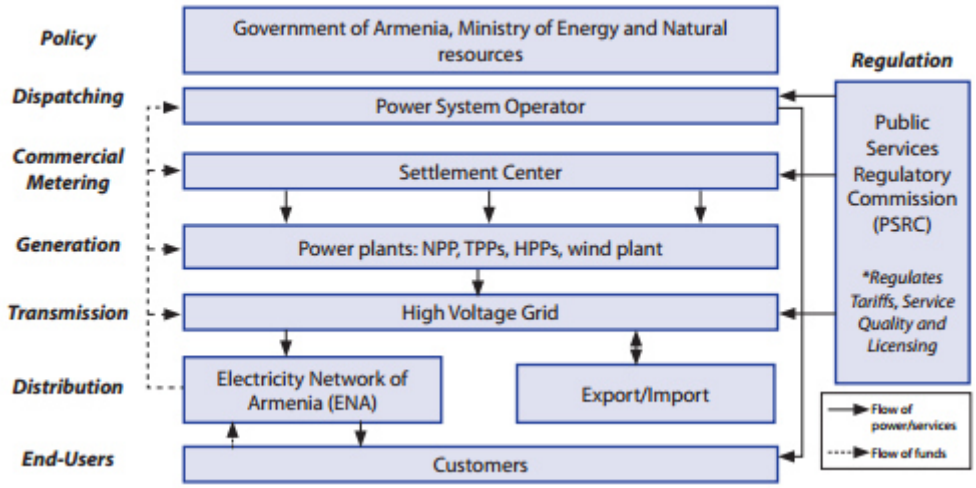
- The Government's policy on energy efficiency and renewable energy will be based on mandatory technical requirements for energy-intensive sectors to ensure energy savings and energy efficiency
- Economic sectors will be classified by energy intensity and mandatory technical requirements for energy saving and energy efficiency will be determined for these new energy intensity categories. These technical requirements will be applied to state funded programs and initiatives (e.g. renovations)
- Market conditions - including further recovery in the domestic consumption market - for energy efficient equipment, devices and products which threaten human life and/ or the environment will be established by a Government Decision of the Republic of Armenia
- Energy flows will be enabled between independent renewable energy producers and license holders for electricity distribution. Independent renewable energy producers, whose installed capacity does not

exceed the total capacity of electricity consumers being supplied (capped at 150 kW), will come out of the regulatory framework.

The adoption of mentioned laws became the basis for restructuring and development of regulatory framework in the field of energy.

The Armenian Energy Sector structure, provided in Figure 1, clearly differentiates between market participants' responsibilities and functions within the sector.

Figure 1 Structure of Armenian Energy Market



The Ministry of Energy and Natural Resources of RA (MENR) and the Public Service Regulatory Commission (PSRC) are the key entities regulating the energy sector. The MENR is responsible for developing primary legislation and main policy documents guiding energy sector activities, including system planning and investment planning for state-owned entities.

The PSRC regulates the electricity and natural gas sectors, and as part of its responsibilities, sets both end-user and supply-side power sector tariffs. The main regulatory operations performed by PSRC include:

- Regulating tariffs, service quality and licensing
- Overseeing compliance with licensee obligations
- Mediating disputes between licensees and customers
- Defining electricity market rules
- Setting, monitoring and enforcing service quality standards

The Ministry of Nature Protection of RoA is the highest executive authority that elaborates and implements the policies of the Republic of Armenia government in the areas of environmental protection and sustainable use of natural resources. It also coordinates the implementation of the activities aimed at meeting the commitments of the Republic of Armenia under the UN Framework Convention on Climate Change. In 2015, the Ministry submitted to the UNFCC the Intended Nationally Determined Contribution (INDC), striving to achieve the aggregated quantitative contribution of 633 mln ton CO2 eq for the period 2015–2050.

The Ministry of Urban Development (MUD) is responsible for construction and building policies and regulation, and for overseeing most of the investments in this sector. MUD is also responsible for the Social Housing Strategy. Energy efficiency-related tasks/functions are included in its charter. MUD has three separate units that have key roles in the urban development sector.

The Urban Development Inspectorate is responsible for enforcement of building norms/ standards.

The "Licensing Centre" agency is responsible for issuing licenses for urban development sector organizations and specialists. The provisions for energy efficiency and energysaving regulation in the construction sector were added to the MUD charter by the decision N225-N of the government of the RoA dated March 14, 2013. According to the Ministry of Urban Development action plan for 2014, the decision "On application of measures directed towards increasing energy saving and energy efficiency in objects constructed by the state means" is already being drafted for adoption by the RoA government.

The Urban Development Project Implementation Unit is in charge of implementing client functions for urban development programmes through the state budget.

2.2.1. Standards for Buildings

Residential buildings

According to Armenian Statistical Service of Armenia, 65% of Armenia's population of 3.23 million inhabitants live in urban areas. There are over 400,000 apartments with a total area of 25 million m2 in multiapartment buildings. The largest portion of the urban housing stock is between 30 and 60 years old, and it typically has poor thermal characteristics and is poorly insulated. All old buildings require some type of repair, and 11% of the buildings are in urgent need of reconstruction.

Buildings represent the largest energy end-use sector, accounting for approximately 38% of electricity and 25% of gas consumption in Armenia[7] (a major portion of both is consumed to cover the heating load, due to the absence/collapse of the centralized district heating system and switching to the individual heating options). In the early 2000s, construction of new buildings began to increase on average by 15–20 % annually. The projected energy consumption in residential buildings until 2030 according to the draft second NEEAP will continue to be between 27% and 29% of the total energy consumption.

A number of laws, regulations and standards were adopted recently that introduced energy efficiency requirements to newly constructed residential buildings as well as for renovation of public buildings, including:

- The Law on Urban Development
- The Law on Energy Saving and Renewable Energy
- Government Decision N225-N, dated March 14, 2013, on the provisions for energy efficiency and energy-saving regulation in the construction sector
- Government Decision N1504-N, dated 25 January, 2014, "On the application of measures directed towards increasing energy saving and energy efficiency in objects constructed (reconstructed, renovated) by state means"

[7] PSRC

- Draft Government Decision on the introduction of systematic mechanisms for reconstruction (repair, renovation) of common spaces (roofs, basements) of multistorey buildings
- "Construction Climatology", RACN II-7.01-2011 Construction norms
- "Multistorey buildings" RACN 31-01 -2014 Construction norms
- 26 National standards, including "Buildings' Energy Passport" NS
- 17 EU and ISO energy efficiency standards and RA standard CN II-7-01-2011 Construction climatology updated
- RA standard Energy Efficiency. Building energy passport AST 362-2013
- RA standard Energy Audit methodology, AST 371-2016
- Building code on thermal protection

The National Programme on Energy Saving and Renewable Energy of the Republic of Armenia (2007) is currently being implemented through the National Energy Efficiency Action Plan (2010). The Plan identifies measures, including new building codes, financial schemes for retrofitting public buildings and certification systems for construction materials. The energy efficiency- and energy-saving-related tasks and functions were added to the MUD charter just a few years ago by government decision N225-N dated March 14, 2013. The project "Improving Energy Efficiency in Buildings", financed by GEF/UNDP, started in 2013 with the objective of creating an enabling regulatory environment, skills and capacity among industry professionals and of introducing the principles of integrated building design into Armenian construction practices from the stage of building design through construction to maintenance of the buildings. The project helped Armenia to draft Technical Regulations, transposing the EU Energy Performance of Buildings Directive. The project also supported the implementation of pilot projects for energy-efficient renovation of buildings, including modernization of a multi-apartment panel building in Yerevan. As a result of the energy efficiency measures introduced, the building energy consumption was reduced from 178 kWh/m2 to 74 kWh/m2). A few other demonstration projects were also carried out in the newly constructed residential sector as well as Yerevan schools. The National Programme on Energy Saving and Renewable Energy estimates a 40% potential for energy saving in Armenia's building sector. According to the results of UNDP pilot projects, an average residential building in Armenia has a 30–50 % potential for energy saving at current energy prices.

Main barriers to energy efficiency investments in multi-apartment residential buildings

- Implementation and enforcement of acting laws and regulations in the field of multiapartment building maintenance and management
- Weak capacity for building management, project development, financial planning and management, fundraising, human resources, reporting and customer/member relations.
- A lack of financial resources due to low maintenance fee rates and low collection rates.
- A lack of overall awareness and understanding of the legal regulatory framework, rights and responsibilities related to the home owners' associations, and benefits of EE, in general.

<u>Public buildings</u>

Schools, universities, colleges, kindergartens, medical institutions and athletic facilities comprise 92% of all public buildings. Over 40% of all public buildings are located in the capital of Armenia. The majority of public buildings are under governmental ownership and direct financing. Most have very low energy performance, largely due to the age, the poor condition of the building envelope and the lack of adequate energy management. On average such buildings have a 10–70 % potential for energy saving. In 2012, the

government of Armenia signed up to an EE programme (worth 10.7 million USD) supported by the World Bank and implemented by the R2E2 Fund. The programme is targeted at implementing energy-saving activities in public facilities to reduce the level of energy consumption by social and other public facilities. Most of the public buildings, however, are underheated with heating ensuring only 40–50 % of the comfort level. The R2E2 credit line has very strict eligibility criteria and can only finance energy efficiency measures that have attractive economic indicators (positive net present value) and successfully finance a number of energy efficiency projects in public buildings and street lighting. All implemented projects had a technical energy-saving potential above 20% and were able to repay the load from the actual savings achieved.

The Armenian Renewable Resources and Energy Efficiency (R2E2) Fund was created in 2006 with the main mission of facilitating investments in energy efficiency and renewable energy and providing an array of comprehensive assistance to project developers, investors, banks, condominiums, researchers and other stakeholders. It provides professional expertise to the government on issues related to green energy development strategies and legislation. The Fund continuously analyses situations, identifying barriers and proposing solutions to relevant government agencies. With the financial support of the World Bank, R2E2 also established a financing mechanism through a revolving lending tool, which finances energy efficiency and renewable energy projects in the public sector. To date, the R2E2 Fund has completed and commissioned 47 subprojects (98 public facilities) with a total investment of US$4.34 million and actual energy savings averaging 50.9%. Sixtyfour projects (US$9.89 million) were approved for implementation, of which one withdrew (National Gallery) due to a change in management. Of these, 47 (US$4.3 million) are completed and commissioned, 11 (US$4.2 million) are under construction and five (US$1.3 million) are under procurement.

Barriers for energy efficiency in public buildings and social housing

- Budget constraints of public building users and a limited ability to commit to a multiyear financial obligation such as a third-party energy performance contract or lease of efficient equipment
- The energy efficiency investments often cannot be implemented alone, due to the major need for capital renovation, for which there is a lack of sufficient funds
- Financing per person (per student, per patient, etc.) at a level not sufficient to cover fixed costs of building maintenance
- Lower comfort level, which, in turn, reduces the economic viability of energy efficiency investments
- A lack of direct incentive for the agency managing and operating the building to save energy or reduce operation costs
- Limited in-house technical capacity and skills for efficient management of energy use
- A lack of legal requirement for periodic energy audit and building energy performance certification.
- Lighting

The electricity-saving potential from the introduction of energy-efficient lighting in the residential sector in Armenia is very high and is estimated to be between 23 ktoe43 and 26 ktoe[8], or around 15% of the 2013 electricity consumption in the residential sector. In addition, lighting renovation in public and commercial buildings could save up to 32 ktoe or almost 40% of the total electricity consumption in the sector. Street and public lighting is reported to be another area with considerable technical potential for cost-effective improvement, particularly in Yerevan and other Armenian cities.

[8] National programme for energy saving and renewable energy, USAID, 2008.

Municipal lighting in the capital city of Yerevan accounts for the largest consumption in the country: 90% of all urban lighting energy use nationwide, or about 56,000 MWh/year. According to a study undertaken within the UNDP/GEF Green Urban Lighting Project, the vast majority of bulbs used in street lighting in Yerevan are high-pressure sodium bulbs (HPS) of 250W capacity (about 93% of all street lights), whereas in the other cities street lighting is "divided" among three main types of lights, namely HPS (46%), mercury bulbs (40%) and CFLs (13%). There are currently no restrictions on the wattage of household lamps in Armenia. Regulations on lighting design and installation in the Republic of Armenia are integrated into building codes and health codes. The building code on natural and artificial lighting regulates the amount of light delivered into given indoor or outdoor spaces, with very limited requirements for energy efficiency. There exists a national law on product standards, including technical standards on lighting, but these existing lighting standards deal with health and safety, not energy efficiency. Furthermore, state procurement law requires equipment to be purchased based on initial costs, without taking life cycle costs into account, to the detriment of EE lighting, which costs less to operate and usually lasts longer than conventional lighting. There is also no state policy regarding the promotion of energy-efficient lighting products.

Energy-efficient appliances and energy-using products are also not regulated in Armenia. A few years ago a draft regulation on energy labelling of household appliances was drafted by MENR, which was approved in December 2015. At the same time, the electricity-saving potential from the replacement of appliances with more efficient models in households is estimated to be 116 ktoe and 39 ktoe in commercial and public buildings, respectively. The general population has some awareness of the potential benefits of EE lighting products (e.g. CFLs) through the advertising of such lamps in various media; however, the low quality of the majority of such products available on the local market contributes to distrust toward them. There is no mechanism for ensuring consumer protection against low-quality, unlabelled lighting products, which sometimes even lack basic information about the producer. Higherquality products are still too expensive for the majority of the population. As a result, most people continue to buy conventional incandescent lamps, thereby avoiding high upfront costs.

The UNDP-GEF "Green Urban Lighting Project", which started in 2014, was aimed at demonstrating the benefits of modern illumination technologies and contributing to the reduction of municipal energy costs related to street lighting. The UNDP, in cooperation with other donors, assisted the Energy Strategy Centre of the Research Institute of Energy in organizing international conferences on Renewable Energy and Energy Efficiency. The project activities are structured around four components:

- Component 1: Knowledge of, and capacities for, green urban lighting – support implementation of technical audits of the urban lighting systems and develop training materials for municipal agencies, lighting and design specialists
- Component 2: Pilot urban green lighting projects – provide technical assistance and incremental investment to support the implementation of pilot demonstration projects for energy-efficient public lighting in Yerevan and other selected urban areas
- Component 3: Financial mechanisms for scaling up municipal energy-efficient lighting programmes – support for private, international and innovative municipal financing for energy-efficient urban and public buildings lighting
- Component 4: National policies, codes and standards for energy-efficient lighting – support the development and implementation of broad policy instruments to promote energy-efficient lighting in Armenia, including a legislative mandate to phase out incandescent and other inefficient lighting, technical standards for lighting products, lighting provisions in building codes and procurement rules for public institutions. The project estimated that the total energy-saving potential of comprehensive modernization of the street lighting system in the urban communities of Armenia is:

Yerevan

- Current total annual power consumption: 37 MWh
- Current annual GHG emissions: 16, 500 tCO2
- Energy-saving potential: 18 MWh/a (>50% potential)
- GHG emission reduction potential: 8,000 tCO2 /a Other municipalities
- Current total annual power consumption: 8 MWh (estimation)
- Current annual GHG emissions: 3,500 tCO2
- Energy-saving potential: 4.8 MWh/a (>60%)
- GHG emission reduction potential: 2,000 tCO2 /a

Other municipalities

- Current total annual power consumption: 8 MWh (estimation)
- Current annual GHG emissions: 3,500 tCO2
- Energy-saving potential: 4.8 MWh/a (>60%)
- GHG emission reduction potential: 2,000 tCO2 /a

2.2.2. Energy Efficiency Laws and Standards

There is no single piece of legislation addressing energy efficiency matters in buildings, but rather a set of documents referring to energy efficiency.

The government has worked towards the implementation of the provisions of the Law on Energy Efficiency and Renewable Energy. The National Programme on Energy Saving and Renewable Energy of the Republic of Armenia was developed in 2007 with the main aim of setting the targets for the energy-saving and renewable energy development in the country and outlining mechanisms for its implementation. The main goals of the National Programme on Energy Savings and Renewable Energy 2007 include:

- Alleviate the inefficient growth of the energy sector by securing intensive implementation of energy efficiency measures
- Efficient consumption of energy resources and maximal employment of renewable energy resources, through the application of targeted economic and legal mechanisms
- Increase the efficiency of energy resource consumption in all sectors of the economy
- Plan the development of the 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
- Direct the finance policy of the country towards energy saving and renewable energy development
- Organize, promote and provide equal accessibility to modern technologies for all members of society, consumer and corporate alike.

In 2011, the government adopted the First National Energy Efficiency Action Plan (NEEAP). This action plan was established to define concrete actions in order to fulfil the aims of the national policy to improve energy efficiency and the usage of renewable energy sources. The action plan was elaborated for the period 2011–2014. The first NEEAP defined a set of policy and programme measures for energy efficiency improvements in all relevant economic sectors. The second NEEAP was prepared in 2015 and adopted in 2017.

NAMA

Armenia submitted its Intended Nationally Determined Contribution (INDC) to the UNFCCC on September 29th, 2015, two months ahead of the Paris COP21 (Conference of the Parties)[9]

In the document, Armenia highlights its vulnerability to climate change, and hence its intent and commitment to pursue an ecosystem approach in its mitigation actions. The report also supports the UNFCCC's definition of a fair approach to climate change, reflected in a "common, but differentiated responsibility", which considers the different levels of historical responsibility among countries in contributing to the increase of greenhouse gas concentration in the atmosphere. Armenia's commitment to the COP21 is to limit its GHG emissions to an annual average of 5.4 CO2 eq. tons per capita for the period 2015–2050. In 2010, Armenia's tons of CO2 emissions per capita was 1.37, and total GHG emissions (CO2 eq.) comprised 2.14 tons per capita. The INDC document states that the main contribution to climate change mitigation will come from the following sectors:

- Energy (including renewable energy and energy efficiency
- Transport (including development of electrical transport)
- Urban development (including buildings and construction)
- Industrial processes (construction materials and chemical production)
- Waste management (solid waste, waste water, agricultural waste)
- Land use and forestry (afforestation, forest protection, carbon storage in soil)

In particular, the government acknowledges the need to restore the capacity of Armenia's forests to increase carbon absorption, and considers that the optimal level of forest land would be 20.1%, which should be achieved by 2050. Additionally, the report acknowledges the role of the **Nationally Appropriate Mitigation Actions (NAMA)** format, which has already been followed in some projects carried out by the UNDP in Armenia. In particular, it highlights the importance of the Measuring Reporting and Verification (MRV) system for the implementation of INDC mitigation measures.

2.2.3. Renewable Energy Laws

Armenia does not have any fossil fuel reserves and heavily relies on fuel imports from Russian Federation (natural gas and nuclear fuel). Renewable energy (mainly large and small hydro and solar) is the only domestic energy resource. The development of renewable energy sources and the promotion of energy efficiency are the main priorities of Armenian energy strategy. Armenia ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 2003[10]. Consequently, the country is committed to mitigate its GHG and to "carry out an energy tariff policy which contributes to the development of renewable energy and creation of favorable conditions for attracting investments in the sector. Privileged tariffs and purchase guarantee are defined for electricity produced by small HPPs, wind turbines and biogas facilities and for electricity produced in combined production systems based on useful heat demand"[11].

[9] http://newsroom.unfccc.int/unfccc-newsroom/armenia-submits-its-climate-action-plan-ahead-of-2015-paris-agreement/

[10] http://unfccc.int/toolsxml/countryAM.html

[11] http://unfccc.int/resource/docs/natc/armnc2e.pdf

Feed-in tariff (FIT) as a power purchase guarantee were adopted in 2004. Over the last 10 years the government has made significant progress in establishing a suitable framework for the deployment of hydro energy. In particular, the regulator has changed the tariffs methodology to address changing market and economy conditions: inflation, currency depreciation etc and support investments in the sector.

In 2008 the PSRC introduced the methodology for the revision of the tariffs for SHPPs based on the following formula:

$$T = T_1\left[K_1\frac{PI}{100} + K_2\frac{ER_1}{ER_2} + (1 - K_1 - K_2)\right]$$

Where:

T - The new tariff, AMD/kWH;

T1 - Existing tariff, AMD/KWh

k1 - Constituent coefficient of existing tariff which is taken equal to 0.35;

PI - The ratio of consumer price index in September of current year to the one in the same month of previous year;

k2 - Constituent coefficient of existing tariff which is taken equal to 0.65;

ER1 - The arithmetic average of AMD/USD exchange rate during the period of January September of current year;

ER2 - The arithmetic average of AMD/USD exchange rate during the period of January September of previous year.

However, due to significant AMD/USD volatility during any given year, the annual tariff adjustments were ineffective. This was demonstrated in 2014, when a 20% depreciation in AMD led to 50% of renewable energy projects going bankrupt. Given the government's commitment to renewable energy, they revised the tariffs and adjusted based on new FX rate and subsequently introduced a new policy in 2015 which allows them to revise tariffs at any point if there is a 10% +/- AMD/USD change.

Small-hydro power plants

According to the rules and regulations of the Public Service Regulation Committee of the Republic of Armenia, a small hydro power plant (SHPP) is defined as any type of hydropower plant with a total installed capacity of up to 30 MW. In 2017 the capacity of the operating SHPPs reached 332 MW (179 operating SHPPs) with annual average generation of about 957 GWh, which is about 13% of the total hydropower generation. In addition, 38 SHPPs are under construction with a total capacity of 71 MW and 246 GWh annual generation.

The evolution of the FITs for SHPPs is presented in the graph below.

Figure 2 Evolution of FITs for run-of-river SHPPs in Armenia (AMD/KWh)

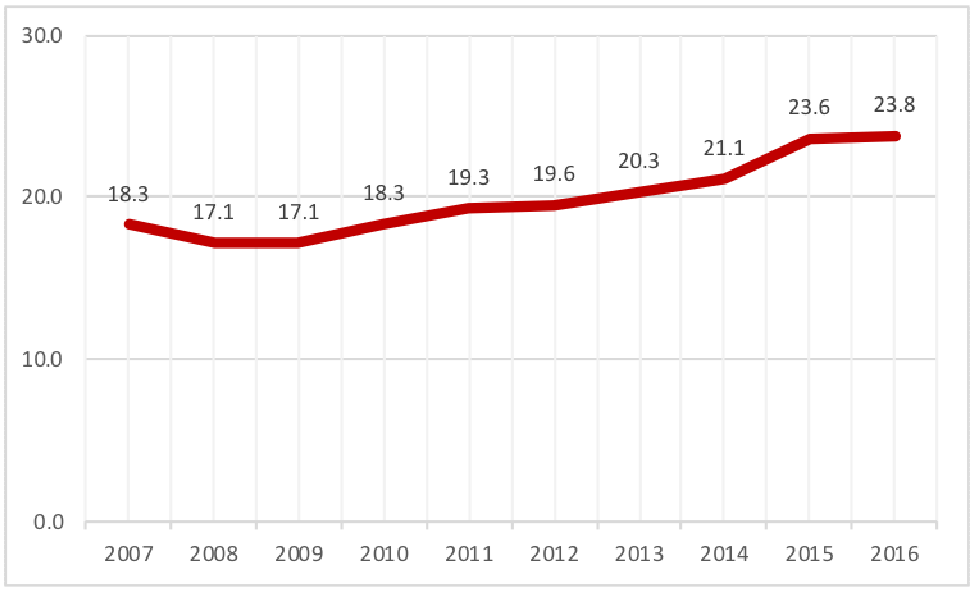
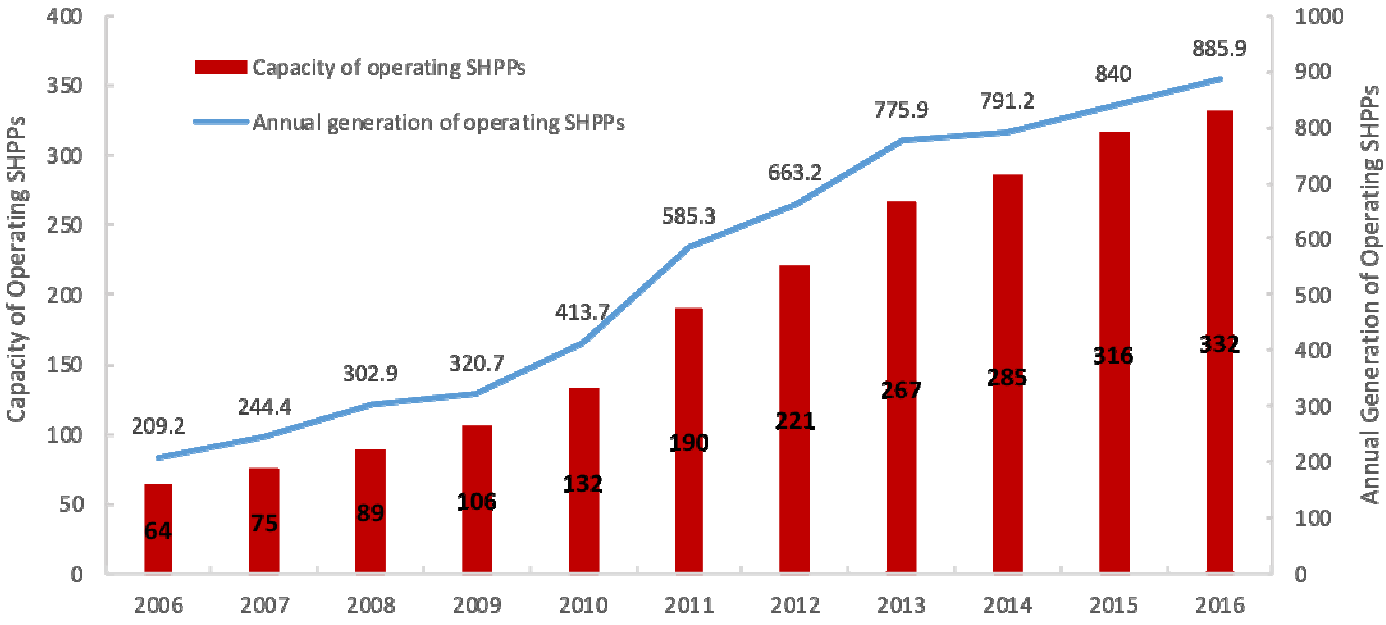


Figure 3 Small Hydro development in Armenia



Wind Power

Armenia has a number of areas with promising wind resources. The most promising areas that have been identified and characterized to date are Zod Pass, Karakach Pass, Pushkin Pass, Sisian Pass and the Fontan region. Together these sites are estimated to have 150 MW of developable resource potential, with estimated capacity factors ranging from 21 to 31 percent, depending on the site.20 The private companies Zodwind and Arenergy have completed feasibility studies for wind plants in Armenia. Two other private companies, SolarEn and MVV-Decon, have conducted wind measurement projects. However, to date no

private companies has moved forward with wind plant development in Armenia. Armenia's only operating wind project is the 2.64 MW Lori 1 plant. Lori-1 was built in in December 2005 under a grant from Iran. The plant has a capacity factor of approximately 11 percent and generates 2.5 GWh per year[12].

Solar Energy

Armenia has good solar PV resources, with annual average global horizontal irradiation (GHI) ranging from 1,490 kWh/m2 to over 2,100 kWh/m2. By comparison, average annual GHI in Europe is 1,000 kWh/m2. The total resource potential for utility-scale solar PV is over 6,500 MW. Assuming polycrystalline solar PV modules mounted at a fixed angle to the sun are deployed in ground-mounted utility-scale plants, solar PV systems could achieve capacity factors of 20 to 24 in Armenia (dependent on location). If single-axis tracking solar PV technology is deployed, capacity factors could be as high as 30 per cent. In addition to utility-scale solar PV, distributed solar PV mounted on building rooftops could also be deployed throughout Armenia, although these plants are likely to have higher costs and lower capacity factors than large-scale, ground-mounted plants. Solar PV deployment in Armenia started in 2017, when the Government adopted net metering rules for small scale PV installations (up to 500KW) and to date has been limited to relatively small-scale rooftop-based installations at schools, hospitals, office buildings and municipal sites throughout Armenia.

- For the development of solar energy, Renewable Energy and Energy Efficiency Fund of Armenia implemented the project "Assistance for Development of Actual Solar PV Energy in Armenia" by the assistance of World Bank and Global Environmental Facility grant.
- Renewable Energy Investment Plan for Armenia was approved in the framework of the "Scaling-Up Renewable Energy Program (SREP)" of the Climate Investment Funds, in accordance to which SREP resources are being allocated to develop up to 110 MW utility-scale solar PV.

The new feed-in tarrifs were approved for solar power plants in 2017 and ht eGovenremnt has autioned 10 small scale (capacity 1 MW) and one industrial scale solar plant (Masrik-1).

The Armenian ministry of energy announced the tender for the construction of Masrik PV station with of 55 MW capacity. The contract has been awarded to consortium **Fotowatio Renewable Ventures and F.S.L. Solar.**

Feed-in tariffs and net metering regulation have supported the deployment of solar energy in Armenia, as of June 2018 there are 314 micro scale solar plants connoted to the grid (total capacity 5.2 MW) and 5 operational small scale PV plants (total capacity 5 MW).

2.2.4. Related laws or standards impacting energy sector development

Development of energy sector has immediate impact on environment; therefore environmental laws/regulations have to be considered in the process of ongoing reforms in the country. Protection of environment and safe use of natural resources is guaranteed by the Constitution of Armenia. Besides

[12] USAID, "Wind Energy In Armenia: Overview of Potential and Development Perspectives," March 2010

primary and secondary legal acts in the field of environment, Armenia is a party to other international agreements binding the country to certain obligations related to environmental aspects.

Climate change adaptation is a priority issue for the Republic of Armenia. As a mountainous, landlocked country, it is characterized by the vulnerability of ecosystems, an arid climate, active exogenous and desertification processes, and frequent natural disasters. These factors make Armenia more sensitive to current and projected climate change impacts[13]. The country's main environmental problems relate to the poor protection of forest areas (covering about 10–11 % of the country's total surface in 2012[14]), resulting in illegal logging and solid waste management, and a reduction in the aggregate volume of river flow resulting from climate change. These issues have been identified by the government, and are being tackled, sometimes with assistance from international organizations. The Republic of Armenia produced its first National Environmental Action Programme (NEAP) in 1998, which listed many and diverse environmental challenges, although it did not establish a comprehensive method for assessing and tackling the identified issues. Nonetheless, some programmes and action plans were prepared and implemented following the first NEAP, especially concerning environmental legislation. The second NEAP (or NEAP-2) was published in 2008, and it was aimed at building on the first programme by developing a more comprehensive approach. A third NEAP is reportedly awaiting adoption by the government, and is set to be published soon.

The Ministry of Nature Protection was created as the Ministry of Nature and Environment Protection after Armenian independence in 1991. The Ministry is the central executive body with responsibility for environmental protection and natural heritage, and is in charge of coordinating actions for the implementation of the UN Framework Convention on Climate Change (UNFCCC) in the country. The Ministry is currently developing a long-term action plan, the third National Environment Action Programme (NEAP), subject to approval by the government[15]. It will replace the existing NEAP-2, produced in 2008. There are four separate agencies dealing with different environmental matters:

- The Bio-Resource Management Agency, which provides services in the field of biodiversity conservation and resource management
- The National Environmental Inspectorate, which has supervisory responsibilities for the functions and application of environmental protection and natural resource use in reproduction
- The Waste Matter and Air Pollution Management Agency, which establishes waste and emission quotas for legal entities and individual entrepreneurs. It runs the registry of waste inventory, including formation, processing and disposal sites
- The Water Resource Management Agency, which deals with surface and underground water management in accordance with the national programme. It also provides qualitative and quantitative monitoring demand for water resources development, and keeps an inventory of the state's water resources. The NEAP-2 highlights the need to establish an institution dedicated to

[13] http://unfccc.int/resource/docs/natc/armnc3.pdf

[14] http://www.tradingeconomics.com/armenia/forest-area-sq-km-wb-data.html

[15] http://unfccc.int/resource/docs/natc/armnc3.pdf

Environmental Impact Assessments, through comprehensive legal institutional regulation, in order to facilitate control and implementation of relevant environmental legislation.

According to the NEAP-2, the Republic of Armenia lacks an overarching law defining environmental policy in general. The objective of such a law would be to provide a basis for the complex management of the different elements for environmental sustainability, and ensure a uniform approach when adopting general measures from international agreements, including policies; programmes; strategies and reports; sustainable development and management approaches; standards; methods and norms; transfer, exchange and application of technologies; implementation of monitoring and studies; collection, presentation and exchange of information; and involvement and awareness of the public in decisions made in the environmental sphere. Additionally, the NEAP-2, published in 2008, argues that there are several contradictions or imperfections, or absence of enforcement mechanisms for certain provisions envisaged under legal acts regulating the environmental sphere. No new laws relating to environmental matters have been adopted since 2008, although government decrees have introduced additional measures concerning air pollution and international conventions:

- The Law on Atmospheric Air Protection (1994)
- The Law on Energy (2001) and the Law of the Republic of Armenia on Energy Saving and Renewable Energy (2004)
- The Law of the Republic of Armenia on Waste (2004)
- The Forest Code of the Republic of Armenia (2005).

Armenian government decrees:

- On Approval of Maximum Permissible Concentration of Air Polluting Substances in Settlements and Maximum Permissible Norms of Hazardous Substances in Emissions from Vehicles Operated in the Republic of Armenia (Decree No. 160-N dated 2 February, 2006)
- On Implementation of Projects within the Framework of the Clean Development Mechanism of the Kyoto Protocol under the United Nations Framework Convention on Climate Change (Decree No. 974-N dated 13 July, 2006
- On Approval of the Procedure on Examination of Design of Maximum Permissible Emission Norms for Organization with Stationary Sources of Atmospheric Air Pollution and on Granting Emissions Permits (Decree No. 953-N dated 21 August, 2008)
- On Approval of Order on Projection, Notification of, and Response to Dangerous Hydrometeorological Events Affecting Extra-normative Pollution of Atmospheric Air, Climate Change, and Ozone Layer Conditions (Decree No. 1186-N dated 16 October, 2008)
- On Approval of Action Plan to be Implemented by the Republic of Armenia Under Commitments of a Number of Environmental Conventions (Decree No. 1594-N dated 11 October, 2011).

The first National Environmental Action Plan (NEAP) produced a series of programmes and action plans that were approved or endorsed by governmental by-laws. Tangible results were achieved in an environmental legislative and regulatory framework, through the development and implementation of sectoral development plans and strategies. Reportedly, public awareness of environmental issues has also increased. While a new NEAP is in the process of being prepared, the second NEAP (2008) is the most recent strategic document laying out environmental priorities. It established an overall framework for integrated environmental management in the Republic of Armenia that aims at optimizing utilization of the country's natural resources and identification of an overall environmental conservation policy. The main

environmental challenges identified in the NEAP-2 are poor natural resource management; pollution of air, soil and water; disposal of solid waste; the depletion of lakes and similar water basins; the lack of public involvement and unequal availability of natural resources; desertification; reduction of biodiversity; exceeding marginal permissible proportions of emissions and leakages into the environment; non-regulated utilization of hazardous substances and waste; and epidemics, and potential natural and technical disasters. Furthermore, the budget dedicated to environmental issues is not significant, only reaching 0.25–0.27 % of the GDP. According to the NEAP-2, more than half of the economic resources supposedly reserved for environmental purposes are actually used to finance other priorities. According to the latest Communication to the UNFCCC, the Republic of Armenia is implementing the following measures:

- Forestry: As a result of the energy crisis in 1992–1995, illegal mass logging led to extremely negative consequences for forest ecosystems. Nonetheless, reforestation and forest conservation activities have been implemented since 1998, and Armenia has expressed the intent to increase forest land to 20.1% by 2050. The "National Forest Policy and Strategy" (2004) and "National Forest Programme" (2005) were aimed at ensuring the conservation, restoration, natural reproduction and sustainable use of forest.
- Solid waste management: Current programmes being implemented in Armenia are aimed at enhancing solid waste management systems. In particular, a landfill gas recovery and flaring system is being introduced in the Yerevan landfill within the framework of the clean development mechanism (CDM) under the Kyoto Protocol
- Water resource management and adaptation to climate change: Summers in most of the regions of the country are usually characterized by hot and dry weather conditions. According to model predictions, these conditions will worsen, leading to negative impacts on water resources and agriculture. Armenia has assessed the vulnerability of water courses, reservoirs and Lake Sevan (the largest body of water in the Caucasus region). Adaptation measures for these issues are presented in the Communication to the UNFCCC, and include actions to take relating to administration and planning, research and information, and infrastructure and monitoring.

Active participation of the Republic of Armenia in international integration processes is considered a critical guarantee for ensuring environmental safety in the country. Hence, the country has joined several conventions to date, such as the Convention on Biodiversity, the Convention on the Conservation of European Wildlife and Natural Habitats, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, and the Convention on Environmental Impact Assessment in a Transboundary Context. The government of Armenia declared in its latest National Environment Action Programme (2008) that it will take the necessary steps to also join the Convention on the Protection and Use of Transboundary Watercourses and International Lakes, as well as ensure ratification of a number of environmental agreements and the conformity of national legislation.

Armenia submitted its Intended Nationally Determined Contribution (INDC) to the UNFCCC on September 29th, 2015, two months ahead of the Paris COP21 (Conference of the Parties). In the document, Armenia highlights its vulnerability to climate change, and hence its intent to pursue an ecosystem approach in its mitigation actions. The report also supports the UNFCCC's definition of a fair approach to climate change, reflected in a "common, but differentiated responsibility", which considers the different levels of historical responsibility among countries in contributing to the increase of greenhouse gas concentration in the atmosphere. Armenia's commitment to the COP21 is to limit its GHG emissions to an annual average of 5.4 CO2 eq. tons per capita for the period 2015–2050. In 2010, Armenia's tons of CO2 emissions per capita was 1.37, and total GHG emissions (CO2 eq.) comprised 2.14 tons per capita. The INDC document states that the main contribution to climate change mitigation will come from the following sectors:

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