

KEY ISSUES OF DEVELOPMENT OF ALTERNATIVE ENERGY AND FORM OF ENERGY EFFICIENCY IN ARMENIA

Anna Arshak Mktchyan-Arshakyan, Marine Armen Nalbandyan

Yerevan “Haybusak” University, Medical Faculty, Haybusak Medical Institute, 6 Abelyan Str.,
Yerevan 0038, Armenia, marinen3@yahoo.com

ABSTRACT

Alternative energy is any energy source that does not use fossil fuels (coal, natural gas, petroleum). Seven types of renewable energy are solar, wind, hydroelectric, ocean, geothermal, biomass, hydrogen energy. Solar and wind energy is widely available in Armenia due to geographic and climate conditions. A green economy is an economy that aims at reducing environmental risks and ecological scarcities. Armenia is a member of the Eurasian Economic Union and has a mixed economic system. The aim is to develop alternative energy sources in Armenia together with the optimized use of natural energy sources. Conservation of resources is the ethical use and protection of valuable resources. Our natural resources should be conserved because it is main source of our daily needs and is limited only.

Taking into account the peculiarities of economic development, as well as based on energy efficiency characteristics and the degree of heat capacity of natural building materials, the most rational and practical approaches to resource conservation will be proposed in the work. Technical and technological solutions acceptable for Armenia will also be considered.

Keywords: solar energy, resource conservation, energy efficiency.

INTRODUCTION

The Republic of Armenia has adopted a policy of sustainable economic development, which assumes harmonized growth for each branch of the economy. Most of the existing power plants in Armenia exceeded their operation life time. The development of renewable energy sources is crucial to the security and quality of Armenia’s electricity supply. Renewable energy, often referred to as clean energy, comes from natural sources or processes that are constantly replenished. Wind and solar energy are examples of renewable sources of energy. For example, sunlight or wind keep shining and blowing, even if their availability depends on time and weather. While renewable energy is often thought of as a new technology, harnessing nature’s power has long been used for heating, transportation, lighting, and more.

Wind has powered boats to sail the seas and windmills to grind grain. The sun has warmth during the day and helped kindle fires to last into the evening. One disadvantage with renewable energy is that it is difficult to generate the quantities of electricity that are as large as produced by traditional fossil fuel generators. This may mean that we need to reduce the amount of energy we use or simply build more energy facilities. The current rates of industrial development resulted in low economic efficiencies throughout the world due to intense utilization of natural resources. The main goal of the current human civilization should be to ensure sustainable development by harmonizing and balancing environmental problems.

According to Armenia’s first national report on climate change with an increase of 2°C, the number of atmospheric oscillations is reduced to 10%, the following negative effects are predicted on the country’s ecosystem’s climate dependent sectors until 2100, moving the boundaries of landscape zones with a mountain profile upwards, increase in climate drying, acceleration of desertification processes (Sargsyan, 2009).

The use of solar energy in Armenia

Armenia's climatic conditions are favorable for the use of solar energy. The average annual amount of light is 2500 hours, and the average multiyear annual energy of total solar radiation per unit area 1720 Kwh/m² (Kreith, & Kreider, 1978). A number of projects have been implemented in Armenia. The Red Cross, Rehabilitation Center has installed a 150m² solar water heating system with built in hot water supply, which is built into the center's hot water supply and heating boiler house. (Sargsyan, 2009). Solar LLC, a leader in the field of research, has installed 20Kw solar photovoltaic power plants and systems, and 660m² solar water heaters in different regions of Armenia.

The use of air flow energy in Armenia

The energy potential of air flows in Armenia is theoretically estimated at about 10.7 billion kWh per year and the technically affordable potential is 1.6 billion kWh (in case of 15% wind use coefficient). The Armnesvet project was implemented in 1999-2002. Financed by the Government of the Netherlands the study of wind energy capacities in some areas of Armenia was implemented. According to investigations five wind stations have been installed near Pushkin passage, Selim passage, Karahachi, Artanish, Lake Arpi (Sargsyan, 2009).

Energy sector is the largest source of greenhouse gas emissions in Armenia. 1991-1993 economic downturn. The energy crisis leads to a sharp decline in primary energy supply. In 1995, primary energy supply was 23% of the 1990 level and 26% of the population per capita.

At the same time, the supply of oil products decreased by about 90%, and the supply of natural gas by about 70%. The majority of the country's total emissions – more than 64% - came from the energy sector. Primary energy supply has been expected to increase in Armenia since 2016. In 2016, primary energy supply was about 39% at 1990 level and 46% per capita (National Greenhouse of the Republic of Armenia, 2016).

The purpose of this article is to reduce energy consumption in public facilities by investing in energy saving measures. Apply the methods that are available for Armenia.

MATERIAL AND METHODS OF WORK

SGP Armenia supports the use of renewable energy efficiency practices. Some examples of completed projects are included in the methodological part, which demonstrate the possibilities and potential of combining various methodological approaches for energy saving.

The methodological document, which demonstrate consideration norm-setting and technical document was developed in Armenia, based on international experience and aims at eliciting energy consumption in buildings (UNDP Project Report, 2016).

In the mountainous town of Artik, 1780 meters above sea level and population of 18,000, a community located in the Shirak region is piloting a residential project aimed to combat climate change. In particular, the project seeks to help Artik's local authorities and housing administration to build their capacity to deal with climate change by piloting the use of renewable energy and energy efficiency practices in apartment buildings in and around Artik. Specifically, the project will support the installation of energy efficient doors and windows, EE lighting system and solar hot water and heating systems (Fig.1). Last December 2009, once the insulation of stairwells was finished, the solar heating system was installed, tested and put into operation. As a result, one stairwell of the building is heated and excess hot water is provided to the residents (UNDP Project Report, 2014).



Figure 1. Project photo gallery, the GEF small grants program, 2010.

Another example. The project goal in this case is to enhance capacities of local communities and management bodies of multi-apartment buildings of the Armenia's regions, for example Shirak region through demonstration of energy efficiency improvement and introducing renewable energy use practices in a pilot multi-apartment residential building as well training of modern and affordable energy efficiency technologies of buildings, software provision. All the works are aimed to increasing of building's energy efficiency. The project will result in increased energy efficiency of a pilot multi-apartment residential building; reduction of use natural gas, thus reducing carbon dioxide emissions from gas stoves/heaters into the atmosphere (UNDP Project Report, 2014).



Figure 2. Renewable energy systems in Shirak

Third example: establishment of Lernarot community "Green" center: Utilizing solar energy potential for the local needs. The community of Lernarot is located at 1730 meters above sea level in mountainous area with harsh winters and a six –month-long heating season.

The community lacks a local administration building, while there is a strong need for some kind of public center to hold community events, especially for the youth. This project addressed the community's social infrastructure needs by constructing a new community center. At the same time, the project tapped into the solar potential found in the high-mountainous community, and showcased the application of solar energy and other energy efficiency measures. This solar technology was installed in the new community center, providing heating and hot water all year round. The application of a solar thermal system in the community center, the use of a public shower unit, and other energy efficient technologies will lead to a reduction of a least 5,200kg/year CO₂ emissions into the atmosphere. In parallel, local capacities were developed for the improvement of local livelihoods and environmental awareness-raising (UNDP Project Report, 2016).

RESULTS AND DISCUSSIONS

Following provisions of the RA law "On energy saving and renewable energy" and based on the list of measures of the RA Government action plan, "On implementation of energy saving and energy efficiency improvement measures in objects being constructed (reconstructed) under the state funding was developed in 2014. The list proposed some measures, among these: insulation of building envelopes, application of energy efficient windows and entrance doors, application of certified insulation construction materials, application of energy saving heating, ventilation, hot water supply, lighting systems, others (UNDP Project Report, 2014).

Based on the assessment of the methodological approaches used in various marz in Armenia, as well as with the aim of expanding the efficiency of the use of energy saving systems in buildings, some measures also can be suggested.

To make the use of thermal energy in apartment house more rational, we can suggest the following work in the heating and hot water supply system through the: Installation of linear balancing valves to balance the heating system, flushing pipelines and risers of the heating system, installation of general house metering devices for heat power plant, installation in the premises of the individual metering devices for hot water (Federal Law of the Russian Federation, 2009).

The energy efficiency of a building depends on the amount of heat escaping through doors and window openings. To reduce it, as a recommendation can be considered: installation an automatic door closing system, installation doors and dampers in basement openings, installation doors and dampers in the openings of the attic.

Additional measures to improve energy efficiency in electricity. To save electricity consumption in public areas, it is recommended to install light and motion sensors that respond to movement or sound. Variable frequency drives should also be installed in the elevator system.

Among unconventional energy sources as a suggestion more convenient to consider: the first stage of hot water preparation due to heat recovery from ventilation emissions- heat pumps, recuperators, a hybrid system with heat storage and heat pumps that use the heat from the ground and ventilation emissions, a hybrid system powered by solar water collectors.

To improve system management requirements for maintaining a building passport for energy efficiency can bring additional positive results. The passport may contain the following information: the amount of energy resources used, on indicators of energy efficiency, on the amount of losses of transferred energy resources (for organizations that transfer energy resources), on the potential for energy saving, including the assessment of the possible saving of energy resources, on the list of energy measures and their cost estimate, others (Energy efficiency passport, 2010).

CONCLUSIONS

The renewable energy sector has experienced an unprecedented boom over the past fifteen years. Renewable energy laws and normative documents have played a key role in this growth by providing regulatory support mechanisms such as research and development funding, feed-in tariffs, competitive tendering, renewable portfolio standards and tax incentives to assist with the

development, commercialization and accelerated deployment of new forms of renewable energy generation.

Nevertheless, the application of the measures already developed by the documentation in practice makes it possible to evaluate all the positive and effective aspects, as well as to promote the development of new proposals and practices.

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