

The State Program on Use of Alternative and Renewable Energy Sources in Azerbaijan Republic

Introduction

Because of gradual shortfall of traditional energy sources and vast hazards to environment yielded by their utilization, developed countries widely use environmentally sound alternative (renewable) energy sources (solar and wind power, small HPPs, thermal waters, biomass power). USA, Canada, Germany, Finland, Norway, Denmark, Spain, Japan and China have leading positions in this area. According to statistics, renewable energy sources (including hydro power plants) constitute 13.5 percent of overall power generation in developed countries.

Wind power has much importance among renewable energy sources. Germany holds the leadership in the world for use of wind power. Adoption of Law on Renewable Energy Sources in this country strongly encouraged the application of wind power installations. More than 35 thousand employees are currently involved in production, installation and operation of wind power facilities in Germany.

Potential energy of water is environmentally pure source in electric power generation. Power generation from this source has had growing trend since 1990. Some countries of Latin America, Asia and Africa as well Northern European countries (which have large hydro resources) have set as a priority to utilize this energy source in the line with other alternative sources.

Direct conversion of thermal power into electric power is widely practiced throughout the world and it is regarded as one of the main areas of energy sector in developed countries. European Union countries and USA have commenced the construction of large-scale power plants to utilize alternative energy sources based on Kyoto Protocol of 1997. The volume of heat energy generated from solar power is significantly higher than in terms of electric power equivalent. That is, this factor is 600 MW in USA, 100 MW in France, 100 MW in Israel, 50 MW in Turkey and so forth.

The USA, Germany, Japan and China employ high-efficiency technologies for development of main working element (photo element) of solar stations which directly converts solar power into electric power. The efficiency factor of these photo elements equals 12-14 percent. The stations developed with such photo elements covers 2 hectares per 1 MW. A number of scientific researches are presently conducted in developed countries to reduce area coverage of photo elements.

Convenient geographical location and climate condition allows for wide utilization of environmentally sound alternative (renewable) energy sources in Azerbaijan. This would save large amount of fuel combusted in thermal power plants, as well significantly reduce hazardous substances. Production of electric and heat energy using alternative energy sources would be incentive for progressive changes in future development of energy sector.

Institute of Physics of National Academy of Sciences, Institute of Radiation Problems, Scientific-Research and Power Design Institute and Baku Hydro Design Institute have undertaken expedient scientific activities towards utilization of renewable energy sources.

This State Program have been prepared based on Law on Energy Utilization; Law on Power Engineering; Law on Energy; Law on Electric and Thermal Power Plants; State Program on Poverty reduction and Economic Development for 2003-2005 approved with Presidential Decree N854 dated February 20, 2003; Measures on

Strengthening Financial Discipline in Energy and Water Sectors approved with Ordinance N893 dated March 25, 2002; Presidential Decree N4 on Furtherance of Socio-Economic Development in Azerbaijan Republic dated November 24, 2003; State Program on Socio-Economic Development of Regions of Azerbaijan Republic for 2004-2008 approved with Presidential Decree N24 dated February 11, 2004; Presidential Decree N458 on Establishment of Ministry of Fuel and Energy dated April 18, 2001; and other normative-legal acts.

1. The objective and major tasks of State Program

The objective of State Program is to promote the power generation from renewable and environmentally sound sources and to more efficiently utilize hydrocarbon energy sources.

The major tasks of State Program include:

- define the potential of alternative (renewable) energy sources for electric power generation;
- raise the efficiency of utilization of country's energy sources by developing renewable energy sources;
- ensure the opening of additional jobs with creation of new energy production sites;
- Given the existing total capacity of traditional energy sources in Azerbaijan, increase the energy capacities at the expense of alternative energy sources and therefore, achieve the country's energy security.

2. Alternative (renewable) energy potential of Azerbaijan

Wind power is the more preferable energy source than solar, hydro, geothermal and biomass for its cost, environmental soundness and unlimited availability.

Practice shows that many of regions in Azerbaijan have great perspective for application of wind power facilities. Calculations suggest that Azerbaijan Republic has about 800 MW annual wind power capacities due to its geographical location, nature and economic infrastructure. This reserve means 2.4 billion kWh of electricity, according to rough calculations. This would imply the saving up 1 million tons of conditional fuel, more importantly, prevention of emitting large quantity of wastes including ozone-cracking carbon dioxide.

Long-term surveys have determined that convenient windy condition prevails in Absheron Peninsula, Caspian seashore and islands in the north-west of Caspian basin. It is feasible to use medium capacity wind power facilities in Ganja-Dahskesen zone and Sharur-Julfa area of Nakhchevan Autonomous Republic because the annual average speed of wind in those regions is 3-5 m/sec.

Japanese company Tomen, together with Azerbaijan Scientific-Research Energy and Power Design Institute, had installed two wind towers of 30 m and 40 m heights and determined that annual average wind speed is 7.9-8.1 m/sec in Absheron. The company had also prepared a Feasibility Study for installment of 30 MW wind power plant in Gobustan region.

Assessment of Azerbaijan's renewable energy sources have been conducted in 2002 and it was determined that Absheron Peninsula has large-scale wind power capacity. The average speed of long-lasting wind is more than 6 m/sec which shows the convenient technical-economic potential for using wind power. The statistical data on wind power gathered in Shimal DRES area have once again justified the above indicators. Based on conducted researches, the presented indicators on Gobustan area

have been included into 4th class of wind energy potential, which is considered as a high potential.

Solar power

The climate condition of Azerbaijan opens great opportunities for production of electric and heat energy using solar power. The annual number of sunshine hours in USA and Central Asia is 2500-3000 hours, 500-2000 hours in Russia and 2400-3200 hours in Azerbaijan.

Development of solar power can partially solve energy problem in many regions of Azerbaijan. Several developed countries have recently started to widely apply Photovoltaic Program (PVP). Involvement of Azerbaijan in this Program can have important role in application of such type of energy systems.

It should be noted that the efficiency of solar stations depends on country's natural climate condition and geographical location. The solar power that comes down to earth totals 1500-2000 kWh/m² annually in USA, 800-1600 kWh/m² in Russia, 1200-1400 kWh/m² in France, 1800-2000 kWh/m² in China and 1500-2000 kWh/m² in Azerbaijan. It is obviously clear that the quantity of solar rays in Azerbaijan prevails in comparison with other countries, which might be regarded as one of the efficiency factors for attracting investments to utilization of solar power.

Small hydro power plants

The weight of generation capacity of hydro power plants within Azerbaijan's overall power system is presently 17.8 percent. 2.4 billion kWh of total electricity generated in 2003 was produced by hydro power plants, which constituted 11.4 percent of overall electricity generation.

There are some hydropower potentials in the country that are still undeveloped up to date. The researches related to this area showed that overall hydropower potential of rivers in Azerbaijan Republic equals 40 billion kWh. The technically feasible potential totals 16 billion kWh, 5 billion kWh of which is related to small hydro power plants.

Construction of hydro power plants has important role in resolution of country-level issues such as regulation of flood waters, environmentally sound electricity generation and creation of new irrigation systems. It is possible to locate dozens of small hydro power plants on rivers and water facilities and these plants can generate up to 3.2 billions kWh annually. For near-term perspective, it would be expedient to install 61 small HPPs. These HPPs can be located on irrigation canals, rivers with unregulated flow and water reservoirs that are under-construction. Use of micro HPPs in electricity supply of objects and settlements that are remote from transmission lines and substations of countrywide grid system can resolve electricity problems, as well social problems.

Given that power system of Nakhchevan Autonomous Republic has no connection with mainland (countrywide) power system, construction of medium, small and micro hydro power plants would be more expedient primarily for Nakhchevan Autonomous Republic.

Biomass power

Rapid development of industry, agriculture and social service in Azerbaijan Republic opens new opportunities for electricity generation from biomass. The sources of bio-substances in the country include followings:

- combustive industrial wastes;

- wastes of forestry and wood-working;
- agricultural and organic wastes;
- domestic and communal wastes;
- wastes processed from areas polluted with oil and petroleum products.

Studies suggest that much of composition of production wastes in all industrial sites is biomass substances. It is feasible to produce biogas, bio-liquid and solid bio-substance that can be used for electricity generation. More than 2.0 million tons of solid domestic and production wastes are annually thrown to waste treatment sites in Azerbaijan Republic. Utilization (processing) of solid domestic and production wastes would partially resolve the problems in heating public buildings in Baku and other large industrial cities.

Many of European countries have already found the ways to solve these problems. That is, waste combustion plants are built in densely populated areas and domestic wastes are fired in those plants. The nearby residential settlements are then provided with electricity and heat at the expense of energy produced from waste combustion. The remains of fired wastes are widely used as a manure to increase fertility of soil. Therefore, construction of such plants having complex importance would be significant for Azerbaijan, too.

2.2 Geothermal power

The heat of earth depth is widely used in industry, agriculture, domestic, communal and health sector in many countries. The advantage of using geothermal power in energy production and consumption is that their application doesn't require large amount of funding.

Azerbaijan Republic is rich with thermal waters. They are usually found in Great and Small Caucasus, Absheron Peninsula, Talish mountain-row zone, Kur lowland and Caspian-Guba area. Exploitation of thermal waters in noted areas would partially cover the domestic and other heat energy needs.

Attracting private investments in connection with implementation of actions envisaged under State Program and maximum use of alternative (renewable) energy sources can be conducive for connection additional capacities to power system.

Actions on utilization of alternative (renewable) energy sources

N	Action	Major executors	Period (years)
1	Prepare proposals on improvement of legislative framework in order to further the utilization of alternative (renewable) energy sources	MFE, MED, MENR, SCAC, MJ	2005-2007
2	Study and application of international experience on utilization of alternative (renewable) energy sources	MFE, MENR, MED, ANAS	regularly
3	Undertake actions towards the encouragement of utilization of alternative (renewable) energy sources	MFE, MED, MF, MT, MJ, SCC, SGMC, local executive authorities	regularly
4	Undertake actions on training specialists for utilization of alternative (renewable) energy sources and education of consumers	ME, MFE, ANAS, MENR	regularly
5	Development of single scientific-methodic coordinating center and database for efficient utilization of alternative (renewable)	MFE, ANAS	2004-2006
6	Conduct scientific researches to determine the potential of alternative (renewable)	ANAS, MFE, MED	regularly
7	Undertake actions towards the furtherance	MED, MFE, local	2004-2006

	of privatization of existing small hydro power plants ("Guba", "Gusar", "Chichakly", "Zeykhur", "Nugedi", "Chinarly")	executive authorities	
8	Undertake actions towards the reconstruction of Varvara Hydro Power Plant	MFE, MED, MWEC, Azerenerji JSC	2005-2007
9	Design and construction of hydro power plant on Vaykhyr River	MFE, MED, MWEC, Azerenerji JSC	2005-2007
10	Carry out the construction of small hydro power plants on mountain rivers and irrigation canals in order to use their potential	MFE, MED, MWEC, SGMC	2005-2013
11	Wide application of wind power plants in accordance with wind power potential in Azerbaijan	MFE, MED, SGMC, ANAS, local executive authorities and municipalities	2004-2013
12	Study the wind power potential in electricity supply in Nakhchevan Autonomous Republic and secure its utilization	MFE, MED, ANAS, MENR, SGMC, CM NAR	2006-2008
13	Application of solar collectors for heating in Absheron Peninsula, Mil-Mugan flatland and Nakhchevan Autonomous Republic	MFE, MED, SCAC, ANAS, Baku CEA, CM NAR, local executive authorities	2005-2007
14	Using local scientific-technical potential and raw materials, Increase the efficiency rate of photo elements used in production of solar power and start their production	MFE, MED, ANAS	2005-2007
15	Provide heat to residential, institutional and other buildings by using the thermal energy of geothermal waters	MFE, MED, MENR, SCAC, ANAS, local executive authorities	2005-2013
16	Application of plastic pipes with lower heat transfer capacity in order to efficiently utilize thermal energy of geothermal waters	MFE, MENR, MED, ANAS	2006-2013
17	Use of geothermal waters for heating greenhouses in fall-winter seasons	Local executive authorities, MA, MFE, MENR, ANAS	regularly
18	Conduct scientific-research works towards the conversion of power of sea high and low tide into electric power	ANAS, MFE	2005-2010
19	Develop modern technologies for production of bio-substances from industrial, agricultural and domestic wastes; undertake works towards construction of small biomass-firing power plants	MFE, ANAS, MENR, MED, Baku CEA, Sumgayit CEA local executive authorities	2005-2013
20	Develop technologies for getting coke brick from oil refinery wastes at refinery plants in order to produce heat energy	MFE, ANAS, MENR, SOCAR	2005-2008

Acronyms

MFE – Ministry of Fuel and Energy

MED – Ministry of Economic Development

MENR – Ministry of Ecology and Natural Resources

MF – Ministry of Finance

MT – Ministry of Taxes

ME – Ministry of Education

MJ – Ministry of Justice

MA – Ministry of Agriculture

SCC – State Customs Committee

ANAS – Azerbaijan National Academy of Sciences

SCAC – State Construction and Architecture Committee

SGMC – State Geodesy and Mapping Committee

MWEC – Melioration and Water Economy Committee under auspices of Cabinet of Ministers

SOCAR – State Oil Company of Azerbaijan Republic

CM NAR – Cabinet of Ministers, Nakchevan Autonomous Republic

Baku CEA – Baku City Executive Authority

Sumgayit CEA – Sumgayit City Executive Authority