ENERGETIKA
ENERGETICS

Published from 2004
Ministry of Press and Information
of Azerbaijan Republic,
Registration number 3337, 07.03.2011

ISSN 1816-2126
Number 01, 2022
Section: English

ECOENERGETİCS

PUBLISHING OFFICE
5, M.Rahim, AZ-1073, Baku Azerbaijan
Tel.: 99412 538-23-70,
99412 538-40-25
Fax: 99412 538-51-22
E-mail: info@ieeacademy.org
ekoenergetics@gmail.com

Internet: http://ieeacademy.org
www.innovationresearch.az

Contents

Properties of graphene based solar panels (review)

R.A.Namazov, R.G.Abaszade

Azerbaijan State Oil and Industry University, Baku, Azerbaijan
resadnamazov852@gmail.com, abaszada@gmail.com

Abstract: Solar panels are a promising and potentially important technology and the future of sustainable energy for human civilization.At the same time, information was provided about graphene-based solar panels. The presented article is devoted to the summary of solar panels.The article examines the characteristics of different types of solar panels. In addition, the characteristics of graphene-based solar panels differ from others.

Keywords: Solar technology, Types of solar cells, Creation of solar cells, Solar panels, Organic photovoltaic, Photovoltaic technology, PV market, DSSC (paint sensitive solar cell).

1.Introduction

But today there is nothing more important than energy, because the lack of energy is an important obstacle for today's civilization. For the development of modern technology new technologies that promise energy demand and even new physical and chemical processes for efficient installation and operation create, transform and systems energy needs to be transported in various forms. Large-scale alternative methods of large-scale production in the future the energy needed to maintain and develop living standards are necessary. In the past, semiconductors of various designs were used to make low-cost solar panels. However, not all of them were successful. Suggestions have been made to recover lost energy. Depending on the conditions, batteries are different. The cheapest are solar panels.Today, there are batteries that are better quality and more useful for energy storage. This article discusses different types of panels. Graphene-based solar panels are the most widely used batteries and have the highest efficiency. The article highlights the pros and cons of several batteries. Graphene-based battery panels are much lighter. Non-encapsulated devices maintain 98% and 95% of the initial values in 1300 hours under 1 sunlight at 25°C and 60°C. This is a very large figure. The potential of graphene material in the solar cell design is investigated by introducing its constitutive parameters. Later, the attenuation constant of the electromagnetic wave illuminated to the graphene slab is calculated to confirm its absorption capability. Finally, using a shell-shaped graphene-based nano-pillar and refractory metal substrate, respectively the impedance matching and transmission blockage conditions are satisfied in the desired spectrum. Multiple parametric studies are conducted to better understand the performance.

Synthesis and Characterization of Graphene Oxide Flakes for Transparent Thin Films talks about the synthesis of GO. As a result of the experiment, it was noted that the solubility of GO is high [1-10]. Abaszade R.G. and others properties of carbon nanotubes added with gadolinium researched and their appilaction possibilities were considered [2]. In the article, is devoted to the analysis of a carbon nanotube, a functionalized b-carboxyl group of a carbon nanotube and a gadolinium-doped carbon nanotube. Were analyzed the structure, purity, quality, and surface morphology, as well as the homogeneity (heterogeneity) of nanotubes. The analysis of a carbon nanotube were performed using a scanning electron microscope (SEM), energy dispersive analysis (EXD), X-ray diffraction analysis, Raman scattering, and IR luminescence. It was found that 10% doping with gadolinium strongly affects the physical properties of carbon nanotubes functionalized by a carboxyl group [3].

A solar cell is made of two types of semiconductors, called p-type and n-type silicon. A solar cell consists of a layer of p-type silicon placed next to a layer of n-type silicon.In the n-type layer, there is an excess of electrons, and in the p-type layer, there is an excess of positively charged holes (which are vacancies due to

the lack of valence electrons). The p-type silicon is produced by adding atoms—such as boron or gallium—that have one less electron in their outer energy level than does silicon. Because boron has one less electron than is required to form the bonds with the surrounding silicon atoms, an electron vacancy or "hole" is created.

The n-type silicon is made by including atoms that have one more electron in their outer level than does silicon, such as phosphorus. Phosphorus has five electrons in its outer energy level, not four. It bonds with its silicon neighbor atoms, but one electron is not involved in bonding. Instead, it is free to move inside the silicon structure.There are batteries with different bases, and of course their characteristics are different.

Gallium arsenide consists of 2 main elements; potassium and arsenic. Gallium arsenide is a semiconductor with a more saturated electron velocity and electron mobility than silicon. A semiconductor is a material that has an electrical conductivity between an insulator and a conductor; can change the ability to conduct electricity when it is cold and hot. This makes it very useful in many applications. Another new quality of gallium arsenide is that it has a direct band gap. This is a quality that expresses a compound that can effectively emit light. Gallium arsenide contains both potassium and arsenic. Gallium is known to cause skin irritation and even dermatitis. Arsenic, which is both a toxic chemical and a carcinogen, has been found to be stable in this compound. This means that it does not break down. Therefore, it does not endanger its users. It can also pass through the digestive system with little ingestion of arsenic. The main function of the GaAs solar cell is to convert the sun's bright light energy into electricity. Gallium is rarer than gold. The cost can be a little damaging. However, potassium arsenide solar cells can generate efficiency levels in the range of 25-30%. This is the area needed for practical use. Gallium arsenide solar cells can have an efficiency of about 25% with just one switch. This makes them a good candidate for assembled solar panels used to collect light from the entire spectrum.

Copper Indium Selenide (CIS) Solar CellCIGs cells are made with a thin layer of copper indium gallium diselenidineCu (In, Ga) Se_2 (CIGS). CIGS cells have an efficiency of up to 10% and with similarsilicone is as durable as solar cells. Because they are thin film technology.It can be cheaper than Si cells. Silicone solar panels are made from the same high-quality boards used to make computers. Monocrystalline silicon consists of a single highly organized crystal. They have maximum efficiency up to 16%.

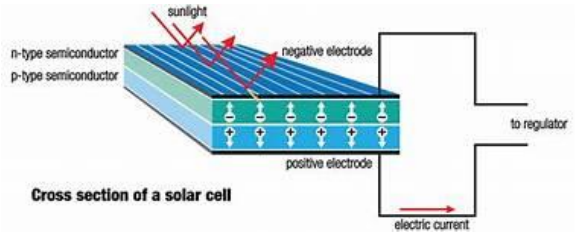

Figure 1. Copper Indium Selenide (CIS) Solar Cell

Polycrystalline silicon solar cells are made of a large number of silicon ingots. These cells can be square and therefore largerare packed more tightly than cells made of round crystal ingots.

Figure 2. Polycrystalline Silicon (poly-Si) Solar Cell

Poly-Si material is cheaper andmore durable than monocrystalline siliconexposed to the sun, but fragile and somewhat expensive. These cells have an open circuit voltage 0.5V DC and 155mA short-circuit current.

Solar power advantages and disadvantages.Although solar energy production is considered a positive thing, it should be noted some disadvantages. Despite widespread government subsidy programs and tax initiatives, the initial cost of purchasing and installing solar panels can be significant. Exposure to the sun is critical, and therefore the earth plays an important role in the production of electricity. Areas that are cloudy or foggy for a long time will produce less electricity. Others defend deficiencies related to insufficient power generation and reliability problems. Energy efficiency is poor compared to other energy sources. There is little correlation between the amount of energy received and the amount of electricity received. Especially compared to other energy sources such as nuclear. The estimated lifespan of solar power plants is 20 years.

2. Experimental details

Graphene based solar panels.Graphene is a two-dimensional material with a honeycomb structure. Its unique mechanical, physical, electrical and optical properties make it an industrially and economically important material in the years to come. One of the applications of graphene is the photovoltaic industry. Studies have shown that graphene can replace a photon absorbed by several electrons, which in practice increases the efficiency of solar panels. In addition, graphene has a low light absorption coefficient of 2.3%, which indicates that it is almost completely transparent material. In addition, graphene is a material with a very high tensile strength, so it can be successfully used in silicon, elastic and organic substrates. So far, significant efforts have been made to use graphene to improve the overall performance

Performance depends on the weather. For example, performance is very poor in areas where the weather is generally cloudy.

In some areas, daytime hours are shortening. Another limitation is the inclination of the Sun relative to the surface of the solar panel. In some regions, the tendency of solar radiation is not adequate. There are many benefits to using solar energy for your home. The benefits range from pollution reduction, investment convenience to energy independence.

2.1 Solar energy is renewable energy

The origin of this main energy source is the Sun. Although the sun has a limited lifespan, it is about one billion years old. Thus, on a human scale, it is considered an inexhaustible source of energy.

The production of electricity or domestic hot water is not polluting and does not generate greenhouse gases. The use of this technology means that residual fuels using fossil fuels can be reduced. For this reason, it is said to be clean energy and environmentally friendly.

of photovoltaic devices. Electrode to replace indium tin oxide (ITO) in a solar cell Demonstrates excellent properties as a lower layer of graphene. Still in 2007 Scientists have developed solar cells using reduced polymers obtained from graphene oxide as a transparent electrode. A single layer of graphene is placed in the new solar cells.It is separated by photogenerated electrons and holes.

Graphene is a new generation material.Solar cells also help increase overall efficiency. Graphene-based Dye-Sensitized Solar Cells Researchers have examined the efficiency of graphene in solar cells by using it on a thin film-like photovoltaic cell known as a ‘dye-sensitized solar cell’. The scientists changed the solar cell by adding a sheet of graphene and covering it with indium tin oxide and plastic transparent backing.

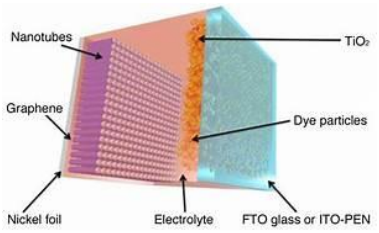

Figure 3. Graphene based solar panels

The use of graphene in solar panels is not new, as it was created as a non-reflective covering for solar cells. Since researchers are pushing graphene's capabilities to gather energy from renewable sources, they have been able to generate thousands of microvolts while achieving a solar panel efficiency of 6.53 percent.

2.2 Synthesis of Graphene for Solar Cells

One of the most important means of producing graphene is using the Scotch Tape Method. Other methods include CVD and recently found experimental approaches that expose the graphene material to a range of temperature variations. Normal duct tape was used by the scientists to peel away layers of graphene using pure graphite until just one layer of graphene remained. Because of the opacity of the material, graphene may be detected under a microscope after the duct tape component has been dissolved in acetone and dried.

Although this is the most frequent way of generating graphene, it is not suited for the fabrication of solar cells. Although small, even a few layers of graphene would be ideal for solar cell production. This method allows scientists to quickly experiment with the material to discover new methods to improve its performance.

2.3 Advantages of Graphene-based Solar Cells.

Advantages of graphene-based solar cells. Because graphene layers are so thin, the production of graphene solar cells requires only a minimal amount of raw materials and significantly lowers prices. Because of its elasticity, scientists have been able to develop a wide range of solar cells that silicon cannot create.This results in unprecedented technological breakthroughs. The transparency and elasticity of graphene make it ideal for solar use in space flights and aircraft, and these features can facilitate the installation of an elastic solar cell. Due to its physical and electrical properties, graphene has many possibilities to adapt to solar cells, and its use is extremely useful for people who consume a lot of energy.Graphene is a layered substance that can be manipulated to create several types of solar cells. Using two layers of this atomically thick substance, scientists have created solar panels much smaller than graphene. These devices can convert photons into electricity with an efficiency of only 1% to 2%, but these layers can be folded to increase the efficiency of the material. Accumulation of graphene can bring its efficiency closer to the efficiency of 15-20% silicone solar cells.

Difference of graphene-based solar panels from othersLet’s be honest, people are now leaning into solar panels. Not only because they are environmentally friendly, but also because when you look at the long haul, they come out cheaper! However, today’s solar panels are only at their best during days with strong sunlight. Their performance starts to wane during cloudy, stormy and rainy days. This may seem like a factor we can overlook now but in the long run, we will definitely see and feel the slowed-down performance’s effect. However, a recent development in graphene-based solar panels could possibly change the game. Graphene in solar panels allows the solar panels to work even during the toughest weather.

Researchers from the Ocean University of China, claims that graphene-based solar cells could draw out energy from raindrops that fall on to the panel by sucking the minimal amount of salt in the liquid.

The graphene layers that build the solar panel should be able to determine the positively charged ions in the rainwater, this also includes sodium, calcium, and ammonium. These positively charged ions stick to graphene’s super thin layer (also commonly known as a pseudocapacitor) with the electrons that are already there. The potential energy and electricity trapped between the two thin sheets is what regulates the electrical current. Solar panels generate less electricity on rainy days than they do on sunny days. But that could change in the future thanks to graphene. Chinese researchers are working on a new kind of solar cell that can generate electricity rain or shine. Graphene is a wonder material that is being studied for many different uses. It is unique in that a graphene sheet is composed of a single layer of carbon atoms. That makes graphene the only known two-dimensional substance on Earth.

2.4 Dye-sensitized solar cells

Researchers from two Chinese universities used dye-sensitized solar cells to develop the new all-weather solar cell. Dye-sensitized solar cells are a low-cost alternative to current technology. These cells simulate the photosynthesis process used by plants by absorbing sunlight. These cells can be made to be flexible, they on backpacks and clothing to power small devices such as phone chargers.

Dye-sensitized solar cells work well in low light conditions including under indoor light and on cloudy days. That makes them an ideal platform for an all-

weather solar cell. They also work well at wider angles to the sun than conventional solar panels. All of these advantages make dye-sensitized solar cells an emerging technology that can be used to integrate solar power into more devices than ever before.

How rain can generate electricity to enable the dye-sensitized solar cells to generate electricity when it rains, a thin layer of graphene is added to the top of the cell. Graphene has unique electrical properties. It readily conducts electricity and has excess electrons that can move with a little encouragement. It's that property that researchers zeroed in on to create an all-weather solar cell.

Rainwater isn't pure water. It contains dissolved mineral salts. These salts are composed of both positively charged particles and negatively charged particles called ions. When you dissolve any salt in water the positively charged and negatively charged particles that the salt is made to chemically dissociate. When that happens, water molecules slightly separate the positively charged ions in the salt from the negatively charged ions.

To generate electricity, the positively charged ions, including calcium sodium, and ammonium, contact the graphene surface of the solar cell. The negatively charged ions from the salt permeate the layer of graphene, enriching it with electrons. The difference between the positively charged water on the surface of the cell and the negative charge of the graphene layer then produces the potential needed for electrical current to flow. This double layer of electrical charges produced by the rainwater is called a pseudocapacitor. Capacitors are electrical components that store electrical energy. In this case, electrical energy is derived by splitting the positively charged ions in rainwater from the negatively charged ions.

2.5 Graphene could power a bright future

Graphene's unique electrical properties have been shown to have promise in batteries, solar cells, and supercapacitors. Its unique electrical properties could be a real game-changer in the field of renewable energy. Solar panels, batteries, and supercapacitors made of graphene are lightweight, flexible, and cheap to manufacture. Graphene could be the super-material that powers the technology of the 21st century. These reasons listed above are the reason why graphene-based solar panels are more ideal.

Grafen and its derivatives have been extensively studied in the field of solar cells with unique properties such as high optical transparency, high electrical conductivity and mechanical elasticity. Many impressive results have been reported in the use of graphene as electrodes, ie transparent mother anodes, opaque anodes, transparent cathodes and catalytic counter-electrodes, as well as graphene as an active layer.

Graphene (a form of fullerene) is a nanomaterial that has been attracting significant interest as a potential game changer for various applications. Energy storage, flexible transparent displays and mechanical supports are only a few of the promising areas of such applications. Graphene is a honeycomb-patterned sheet of carbon atoms, with a thickness of one carbon atom. This makes it a two-dimensional material, which despite its thinness manages to be 200 times stronger than steel. It is also almost entirely transparent and an excellent conductor of heat and electricity.

In the past few decades, fullerenes have been a center of active research investigations thanks to their extraordinary physical, chemical, and mechanical properties. These properties makes them an outstanding material for future electronics, optics, and energy-harvesting applications. To date, a number of different types of solar cells have used graphene electrodes. This includes solid-state solar cells, electrochemical solar cells, quantum dot solar cells (QDSCs), and polymer solar cells.

3. Conclusions

Graphene is a new generation material andSolar cells also help increase overall efficiency. It replaces various materials such as platinum at a low price. Indium and other basic batteries try to compete with it. This paper introduces the use of graphene in dye-sensitive solar cells, organic solar cells, Si solar cells, perovskite solar cells, and shows its differences and advantages over other basic batteries. Research on the properties of graphene in solar cells is applied only on a laboratory scale. In order to study the behavior of photovoltaic modules in real conditions, it is necessary to solve the following problems: production of large graphene with repetitive properties, no defects, high stability. A promising method for the production of graphene on such parameters seems to be a synthesis from the liquid metal phase method. Another important aspect is the ability to produce graphene on different substrates to overcome the

problems that arise during the transfer of graphene from one material to another.

References

1.R.G.Abaszade, S.A.Mamedova, F.G.Agayev, S.I.Budzulyak, O.A.Kapush, M.A.Mamedova, A.M.Nabiyev, V.O.Kotsyubynsky, Synthesis and characterization of graphene oxide flakes for transparent thin films, Physics and Chemistry of Solid State, Vol.22, №3, pp.595-601, 2021.
https://scholar.google.ru/citations?view_op=view_citation&hl=ru&user=rCtORvkAAAAJ&citation_for_view=rCtORvkAAAAJ:k_IJM867U9cC
2.R.G.Abaszade, O.A.Kapush, A.M.Nabiyev, Properties of carbon nanotubes doped with gadolinium, Journal of Optoelectronic and Biomedical Materials Vol.12, №3, pp.61-65, 2020.
http://lib.pnu.edu.ua:8080/handle/123456789/
3.R.G.Abaszade, O.A.Kapush, S.A.Mamedova, A.M. Nabiyev, S.Z. Melikova, S.I. Budzulyak, Gadolinium doping influence on the properties of carbon nanotubes, Physics and Chemistry of Solid State, Vol.21, №3, pp.404-408, 2020.
https://scholar.google.ru/citations?view_op=view_citation&hl=ru&user=rCtORvkAAAAJ&citation_for_view=rCtORvkAAAAJ:qUcmZB5y_30C
4.S.R.Figarova, E.M.Aliyev, R.G.Abaszade, R.I.Alekberov, V.R.Figarov, Negative Differential Resistance of Graphene Oxide/Sulphur Compound, Journal of Nano Research Submitted, Vol.67, pp.25-31, 2021.
http://dx.doi.org/10.4028/www.scientific.net/JNanoR.67.25
5.S.W.Glunz, R.Preu, D.Biro, Crystalline silicon solar cell: State of the art and future developments, in Comprehensive Renewable Energy, Vol.1, pp.353-387, 2012.
https://doi.org/10.1016/B978-0-08-087872-0.00117-7
6.W.Ch. Oh, Y.Areerob, Modeling dye-sensitized solar cell with grapheme based on nanocomposites in the Brilliouni zone and density functional theory, Journal of the Korean Ceramic Society, Vol.58, pp.50–61, 2021.
https://link.springer.com/journal/43207/volumes-and-issues/58-1
7.J.Szlufcik, S. Sivoththaman, J.F.Nijs, R.P.Mertens, R.V.Overstraeten, in McEvoy's Handbook of Photovoltaics (Third Edition), pp.129-158, 2018.
https://www.sciencedirect.com/topics/engineering/contact-solar-cell
8.S.W.Glunz, R.Preu, D.Biro, Crystalline Silicon Solar Cell: State-of-the-Art and Future Developments, in book: Comprehensive Renewable Energy, Vol.1, preprint of chapter 1.16, 2012.
https://doi.org/10.1016/C2009-0-19749-0
9.S.J.Fonash, in Solar Cell Device Physics (Second Edition), 354p. 2010.
http://www.fulviofrisone.com/attachments/article/403/solar%20cell%20device%20physics.pdffStephan
10.J.S.Kumari, Ch.S.Babu, Mathematical Modeling and Simulation of Photovoltaic Cell using Matlab-Simulink Environment, Inter-national Journal of Electrical and Computer Engineering (IJECE) Vol.2, №1, pp. 26-34, 2012.
http://www.ijece.iaescore.com/index.php/IJECE/article/viev./5368

Waste reduction in Balakhani industrial park. Information about residents

L.H.Mammadova, N.G.Suleymanova

Azerbaijan University of Architecture and Construction, Baku, Azerbaijan
l.mamedova.ekologiya@gmail.com, nazxanimsuleymanova51@gmail.com

Abstract: The article provides information about Balakhani Industrial Park and its main residents. A number of static data were collected and analyzed. General information on the activities of residents was collected and the work done to reduce waste was analyzed. A lot of new work has been done in our country in recent years to reduce it.

Keywords: General information about waste, Waste circle, Working principle of Balakhani Industrial Park, Residents of Balakhani Industrial Park, Waste reduction.

1.Introduction

Waste is mainly generated in human settlements as a result of normal human activities, which consists of objects, substances and materials.

Balakhani Industrial Park, located in Baku, is located in Balakhani settlement. The Solid Waste Sorting Plant with an annual processing capacity of 200,000 tons and the Solid Waste Incineration Plant with an annual capacity of 500,000 tons are located near the park.

Objectives:	**Plans:**
Expanding the recycling business	Creating a common and sustainable infrastructure
Increasing the production of green products	Related location of processing, production and service areas
Application of innovative technology	Reducing the impact of industry on the environment
Implementation of information and knowledge exchange	

Delivery of waste to Balakhani Industrial Park is carried out by the Baku City Department of Housing and Communal Services. Baku Department of Housing and Communal Services on the basis of the order of the Head of Baku City Executive Power "On measures to improve the management system of Baku city housing and communal services" No.444 dated May 12, 1999 was established as a single governing body in the field.

Baku City Department of Housing and Communal Services to improve housing and communal services to better meet the needs of the population in housing and communal services, management of housing and communal services on the balance sheet, increase the level of operation of housing stock and utilities, adaptation, protection measures, maintains a normal level of sanitation and performs other functions related to the city's housing and communal services.

Wastes generated by farms and households cause environmental pollution, which can be illustrated by the following scheme:

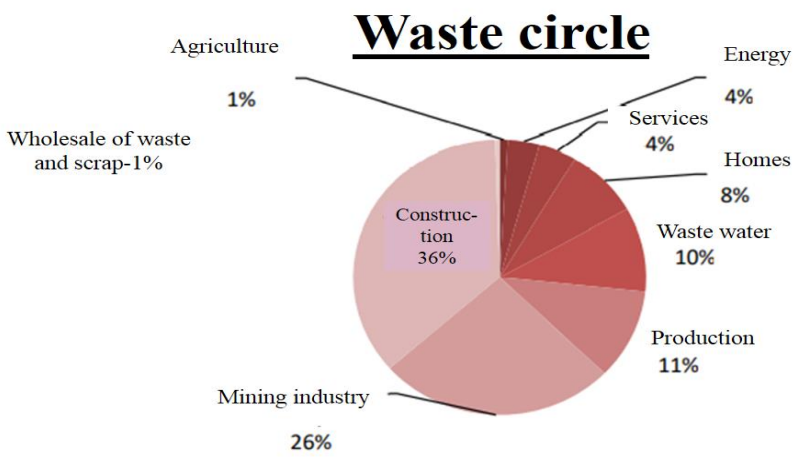

Figure 1. Waste circle

New modern containers for household waste have been installed in 7 districts (Sabail, Narimanov, Yasamal, Nasimi, Binagadi, Nizami and Khatai). The Baku City Executive Power has established a Monitoring Center n the basis of a project submitted by the company. The center has created the most modern conditions for the work carried out by the working group on the development and implementation of the concept.

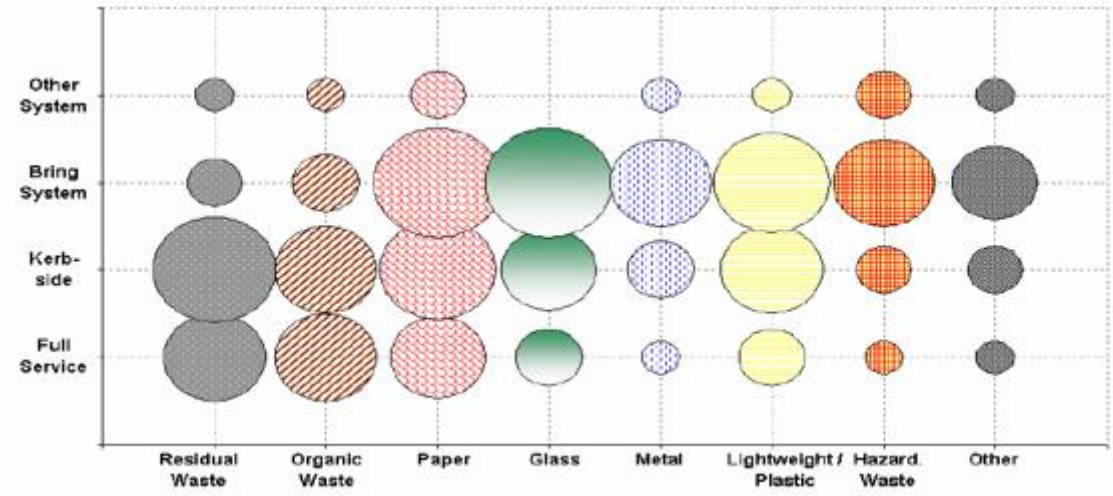

Figure 2. Overview of waste collection systems used by cities and regions

About 1.5 million tons of waste is generated in Baku every year. This figure is growing as Baku expands and develops. Proper collection, treatment and sorting of waste is an important condition. Most of the waste is taken to suburban landfills. Nevertheless, progress has been made in sorting the waste in Balakhani and sending it to power plants. As a city that has signed innovative projects such as Baku White City, there is a need for a high-level waste management system in Baku. Baku City Executive Power aims to improve the system of waste collection, sorting and management for residents.

Balakhani Industrial Park was established by the Order No. 1947 of the President of the Republic of Azerbaijan, Mr. Ilham Aliyev, dated December 28, 2011, and its foundation was laid on December 19, 2012 by the President of the country. Balakhani Industrial Park with a total area of 10.15 hectares is managed by Tamiz Shahar OJSC. Balakhani Industrial Park is an area with the necessary infrastructure and management facilities for

entrepreneurship, used to produce competitive products and services through the application of modern technologies, which contributes to the development of green business

Figure 3. View of the general plan of Balakhani Industrial Park

The main goal of creating this park is to create favorable conditions for potential entrepreneurs and investors interested in the field of reproduction. All conditions and necessary support for mechanical processing and production facilities in the common area of the park have been provided by the Government. The proximity of the Industrial Park to the Balakhani landfill and waste incineration plant, as well as to the main transport hub, has facilitated the supply of raw materials and energy and the easy access of raw materials or products to the market.

In general, the volume of household waste generated in Baku during 2000-2009 is shown in the diagram below.

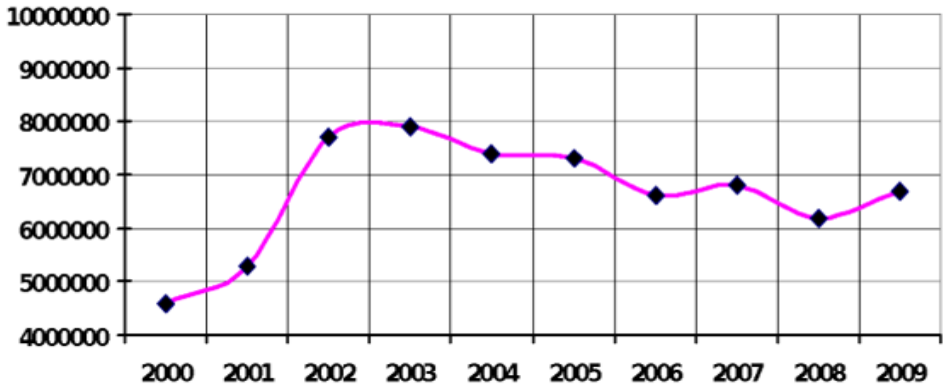

Figure 4. The volume of household waste generated in Baku during 2000-2009 is shown in the diagram

In 2000 - 4.6 million. m^3;
In 2001 - 5.3 million. m^3;
In 2002 - 7.7 million. m^3;
In 2003 - 7.9 million. m^3;
In 2004 - 7.4 million. m^3;
In 2005 - 7.3 million. m^3;
In 2006 - 6.6 million. m^3;
In 2007 - 6.8 million. m^3;
In 2008 - 6.2 million. m^3;
In 2009 - 6.6 million. m^3.

As a result of the research, it was found that 35% of UN food waste, 20-40% paper, 4-5% old textile, 3-5% wood, 4-5% glass shards, 1-2% black and It consists of non-ferrous metals and up to 10% of

polymeric materials. Most of the waste generated in the settlements and cities of this area (97%) is transported to the places allocated by the municipal authorities without utilization. In general, this has a negative impact on the sanitary and environmental condition of the territories. A small part of solid waste (1.5-2.0%) is incinerated and processed (1.0-1.5%).

UN landfills	Year of commissioning	Total area, ha	Exploited area		Waste transported to the landfill during the week, m^3	Monthly waste, m^3
			ha	%		
Balakhani	1963	200,0	30,0	15	23958,7	107814,2
Azizbayov district	1980	5,0	1,75	35,0	1064,9	4792,3
Surakhani district (suspended)	1994	21,0	5,3	24,3	3816,1 The waste is transported to the Balakhani landfill	17172,7
Garadagh district (activity suspended)	1994	25,0	3,0	12,0	1138,3 The waste is transported to the Balakhani landfill	5122,75

There are landfills for household waste in Baku:
According to current statistics, the annual growth of waste is 0.5%. Sometimes waste is not sorted and collected, which does not allow them to be fully processed. Due to the lack of garbage containers and specialized vehicles, there are serious problems with the collection of household waste in some areas. According to official data, there are 2,540 garbage collection points in the city, 3 landfills in Sabunchu, Surakhani and Garadagh districts. The largest of these is the Balakhani landfill, which has been operating since 1963.

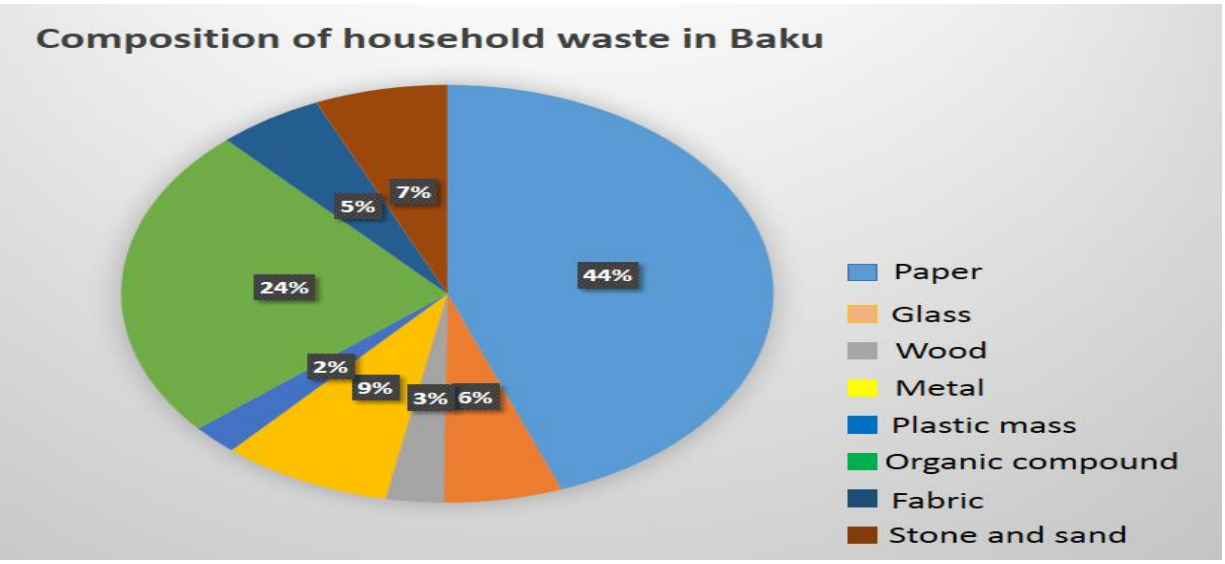

Figure 5. Composition of household waste in Baku

Last year, the country generated 3476.8 thousand tons of waste, or 14.1 percent more than the previous year. 61.7% of these wastes were solid household wastes, and 38.3% were various types of wastes generated as a result of production activities of enterprises.

In general, there have been significant benefits to the establishment of the Balakhani Industrial Park, which is leading the way in reducing waste. It has led to the establishment of Residents in Balakhani Industrial Park, which operates in Tamiz Shahar OJSC, and has received great support from the state. Residents have worked on various wastes and made many innovations to reduce waste. New raw materials are also obtained from waste. Detailed information with these residents is provided below. Residents of the 1st area of Balakhani Industrial Park

Ekokat LLC. Ekokat LLC mainly recycles used engine oils. Ekokat LLC has an investment of 1.0 million manat. With an annual production capacity of 3,000 tons, this Resident employs 15 people. The total area is 1100 m^2.

Taking into account the recommendations and instructions of the President of the Republic of Azerbaijan on the cleaning of Absheron and the Caspian Basin from oil waste, the newly established "Ekokat" LLC has conducted extensive research in this field, involving a number of well-known scientists and specialists (especially specialists working at the Azerbaijan National Academy of Sciences). found that almost no attention was paid to the management of used oils (especially used motor oils), which are a major source of danger. It should be noted that in all advanced countries of the world, great importance is attached to the centralized collection and regeneration of used oils. This issue is even more urgent, especially due to the declining oil reserves in the world.

Figure 6. Ekokat LLC

AZ. Ekol MMC. Az Ekol LLC is a resident engaged in plastic (recycling of pet bottles). The investment amounts to 1.5 million manat. The plant has an annual production capacity of 2,400 tons and employs 30 people. The area is 1600 m^2.

The product of polycondensation of terephalic acid (or its dimethyl ether) with PET ethylene glycol and the white transparent crystalline state becomes transparent at 70°C and remains the same as a result of sharp cooling.

Here is the process of recycling paper waste. The investment amount is 1.0 million manat. The plant has an annual production capacity of 350 tons and employs 15 people. The total area is 2100 m^2.

Fifty percent of the waste is paper. 93% of the paper produced is made of wood. Today, 42 percent of the world's trees are felled for paper production.

Figure 7. MET-AK LLC

MET-AK LLC. It recycles plastic materials from waste, produces fruits and trays from waste paper. The plant with an investment of 19.2 million manat also imports to foreign countries. The plant has a total of 175 employees. With an annual production capacity of 12,000 tons, this plant is the largest. The area is 4000 m^2.

Foriella LLC. It is the only factory in this field engaged in the recycling of sponge waste and furniture production. The investment is estimated at 3.5 million manat. The annual production capacity is 100,000 chairs and 10,000 tables. The plant, which employs 150 people, has an area of 4,000 m^2.

Perla is a furniture brand owned by Foriella and launched in 2018. The company produces and sells home furniture in Azerbaijan under this brand name.

Under the Perla brand, bedding, guest, upholstered, children's furniture, mattresses and other furniture products are produced. In addition to the Republic of Azerbaijan, the company exports its products to the United States, Russia, Georgia, Kazakhstan, Tajikistan, Kyrgyzstan and other countries with a very wide range of products. (Margin)

Figure 8. Bioropean LLC

Residents of the 2nd area

Bioropean LLC. It is a plant engaged in the processing of used edible oils and the production of raw materials for biodiesel. The plant has an investment of 0.5 million manat and employs 5 people. The area is 300 m^2.

Biodiesel is derived from plants or animals and is a type of diesel fuel consisting of long-chain fatty acid esters. Typically, lipids such as animal fat,

soybean oil, or other vegetable oils are prepared by chemically reacting with an alcohol to form a methyl, ethyl, or propyl ester.

Carboza LLC. Processing of wood waste and production of coal (activated carbon). The annual capacity of this plant is 1200 tons.

References

1.https://www.stat.gov.az/news/index.php?id=4567

2.Decree of the President of the Republic of Azerbaijan "On measures to accelerate socio-economic development in the Republic of Azerbaijan", Baku. 2003.
http://idp.gov.az/az/law/10/parent/15

3.Order of the President of the Republic of Azerbaijan "On improving the management of household waste in Baku", Baku, 2008.
http://www.e-qanun.az/framework/15230

4.A.M.Azizov, L.H.Mammadova, Integrated waste management, book, 261p., 2020.

5.Order "On improving the management of household waste in Baku", Baku, 2008(in Azeri)

6.Tamiz Shahar, OJSC magazine (2009-2019)
https://files.preslib.az/projects/nax/pressa.pdf

Monitoring system for electromagnetic compatibility of Power lines

A.B.Balametov[1], T.M.Isayeva[2]

[1]*Azerbaijan Scientific Research and Project Energy Institute, Baku, Azerbaijan*
[2]*Azerbaijan State Oil and Industry University, Baku, Azerbaijan*
taranaisaeva@rambler.ru

Abstract: Currently, there is no software for assessing the electromagnetic compatibility of overhead lines. Mathematical modeling of the effect of corona wires of overhead lines, electromagnetic interference, corona discharge, radio interference in wires is considered. The EMC software was developed to assess the environmental impact of high voltage AC transmission lines. Using the example of a 500 kV overhead line, the results of a complex system for modeling the losses of the overhead line due to corona, the electric field voltage and active energy losses due to radio interference are presented.

Keywords: Environmental impact, Overhead power lines, Electric field, Magnetic field, Corona losses, Radio interference, Acoustic noise, Electromagnetic compatibility.

1.Introduction

The issues of the environmental impact of high-voltage transmission lines are becoming relevant in connection with the development of high-voltage electrical networks of 110, 220, 330 kV, ultra-high voltage (UHV) 500-750 kV and ultra-high voltage (UHV) 1150 kV [1-5]. The harmful effect of the magnetic field on living organisms, and primarily on humans, manifests itself only at very high intensities of the order of 150–200 A/m, which occur at distances up to 1–1.5 m from the wires of the overhead line (VL) phases, and is dangerous when working under voltage. The direct influence of the electromagnetic field of the EHV and LHL lines on a person is associated with the effect on the cardiovascular, central and peripheral nervous systems, muscle tissue and other organs [1,8]. In this case, changes in pressure and pulse are possible. palpitations, arrhythmia, increased nervous excitability and fatigue. The harmful effects of a person's stay in a strong electric field depend on the field strength E and on the duration of its exposure to 5 kV/m. Permissible duration of periodic and prolonged stay in the electric field: 20 kV/m - hard-to-reach - 10 min; 15 kV/m - uninhabited area 90 min; 10 kV/m for road crossings 180 min. The fulfillment of these conditions ensures the self-healing of the body during the day without residual reactions and functional or pathological changes.

Radio interference occurs with corona on wires, partial discharges and corona on insulators and

fittings, sparking in the contacts of linear fittings [6-7].

Electromagnetic compatibility of technical means (EMC) is the ability of a technical means to function with a given quality in a given electromagnetic environment and not create unacceptable electromagnetic interference with other technical means.

To eliminate radio interference in the security tone, the permissible tension on the surface of the wire is reduced. Corona discharge on power lines interferes with radio and television reception, as well as acoustic noise. The main cause of radio interference and noise is the streamer corona on the wires. Since the most favorable conditions for the appearance of a streamer corona are formed during precipitation, when the initial field strength is significantly reduced, the strongest radio interference and acoustic noise occur during corona of ultrahigh voltage lines during rain and snow. In good weather, interference increases as the wires get dirty. The frequency spectrum of radio interference radiation covers the range from 10 kHz to 1 GHz. Interference at frequencies above 30 MHz has an interfering effect on television reception and occurs only during corona lines of 750 kV. To solve the problems of EMC

overhead lines and radio receivers for various purposes, the real levels of the field strength of interference generated by overhead lines are important.

The initial value in the development of standards for radio interference is the guaranteed level of the protected useful signal. In accordance with international practice, the minimum field strength of the radio signal, which must be protected from interference at a frequency of 1 megahertz, is 60 decibels, and at a frequency of 0.5 megahertz - 66 decibels.

To solve the problems of EMC of power lines and radio receivers for various purposes, the real levels of the field strength of interference generated by overhead lines are important. Interference from overhead lines can occur not only from corona on wires, but also due to partial discharges and corona on insulators, breakdown or overlap of defective insulators, corona on linear fittings and spacers of split-phase wires, and also due to sparking between elements of linear fittings, spacers wires and between insulators. The reduction of radio interference from overhead lines and the improvement of the electromagnetic situation along the routes is facilitated by the regulation of the levels of radio interference from overhead lines.

Most countries have national regulations for interference field strengths from overhead power lines and high voltage equipment.

Corona on wires is the main source of radio interference on high and extra high voltage overhead lines and interference to high-frequency communication channels. Corona also leads to additional losses of electricity on overhead lines. On wires of overhead lines, in addition to irregularities caused by wires of the upper layer, there are always surface damage (scratches, burrs), contamination (traces of grease, particles of organic and inorganic origin) and atmospheric deposits (raindrops, dew, snow, frost, ice, frost). This leads to a local increase in the electric field strength and, as a result, to the appearance of a local corona at individual points of the wire. The characteristics of radio interference and local corona losses depend mainly on the electric field strength on the wire, its diameter, surface condition, meteorological conditions and are subject to significant scatter.

Precipitation has a strong influence on the level of radio interference and the magnitude of corona losses, so it is necessary to have information on the average annual duration of the following main weather groups, each of which is characterized by its average level of losses: - the first group - fine weather (H.P.); - the second group - dry snow (s.s.). Dry snow also includes snow groats, snow grains, ice needles, blizzards, blizzards with snowfall (with the exception of a blowing snowstorm and snowfalls that do not reach the wires); - the third group - rain (d). Drizzle and sleet should also be referred to as rain, since their effect on corona losses and on the level of radio interference is close to that of rain; - the fourth group - frost (from). The frost group also includes: ice, frozen snow and wet frozen snow. All other types of weather belong to the group of good weather.

The block diagram of the integrated system for assessing the impact of coronation of overhead line wires on the environment is shown in Fig. 1.

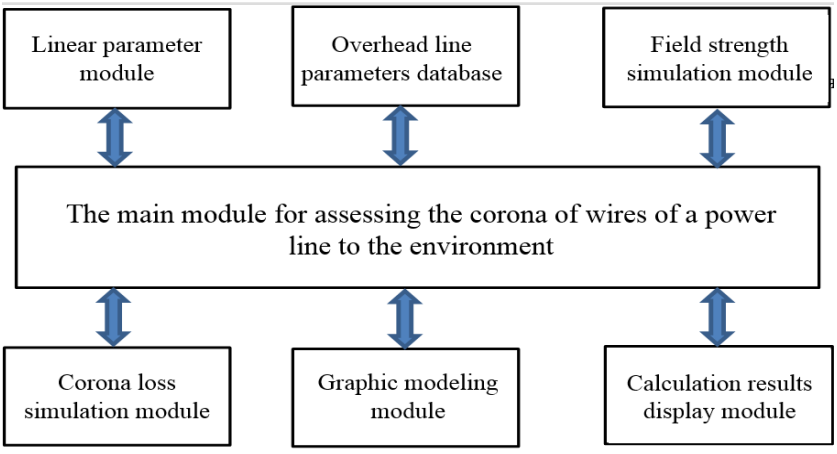

Figure1. Integrated system for assessing the impact of overhead line staging on the environment

2. Experimental details

Calculation of the electric field strength on the surface of the wires.

The main factor determining corona losses and radio interference on overhead lines is the ratio of the electric field strength on the surface of the wires to the initial corona strength. A small change in this ratio leads to a significant change in corona loss and radio interference. For overhead lines with single wires, the electric field strength E on the surface of the wire is determined by the formula [6-7].

$$E = \frac{q \cdot 10^{-3}}{2\pi\varepsilon_0 r_0} kV/sm(10^5 V/m)$$

Where, q is the linear charge density on the wire (see Appendix 1), K/m; r_0 - radius of a single wire, cm (10-2m); ε_0- dielectric constant of air.

In a split wire, the field strength is unevenly distributed over the surface of the component wires. In this case, the average strength E of the field on the surface of the wire is determined by the formula

$$E = \frac{q \cdot 10^{-3}}{2\pi\varepsilon_0 n r_0} kV/sm(10^5 V/m)$$

Where, r_0 is the radius of the components of the split wire, cm (10^{-2} m).

Maximum intensity for split wire

$$E_m = k_n E \cdot kV/sm \cdot (10^5 V/m)$$

where κ_n is the coefficient of uneven distribution of the charge over the surface of the component wire.

$$k_n = 1 + (n-1)\frac{r_0}{r_p} = 1 + \beta\frac{r_0}{a}$$

Where, r_p is the splitting radius; a - splitting step of the split wire cm (10^{-2}m).

The value of β depending on the number of component wires in a split wire is determined by the formula

$$\beta = 2(n-1)\sin\frac{\pi}{n}$$

The basis of the calculation for an arbitrary 3-phase overhead line with two cables is the solution of the system of Maxwell equations [1].

To calculate the field strengths on the wires, the working capacitance of the wire is used, which is defined as the ratio of the linear charge density of the wire to the phase voltage of the overhead line.

In the developed program for calculating power losses per corona, algorithms for calculating the capacitance of a three-phase overhead line with an arbitrary arrangement of wires with one and two cables (Fig.1) are implemented.

For a three-phase AC overhead line with single (n=1) and split wires

$$E = 0{,}0147\frac{C_k U}{n r_0} kV/sm(10^5 V/m)^*$$

Where, $C_к$ is the working capacitance of the k-th phase of the overhead line, pF / m (10^{-12}F/m); U - average operating voltage per year along the overhead line, kV (10^3V).

When calculating the power losses to the corona on split wires, the equivalent electric field strength $E_э$ is used, which is determined by the formula

$$E_e = \frac{E + E_m}{2} = \frac{1 + k_n}{2} E\ kV/sm(10^5 V/m)$$

To unify the calculations of corona loss power for all weather groups, the basic value of the initial field strength E_0 on the surface of the wires was introduced, which corresponds to the appearance of a common corona in good weather conditions. The value of E_0 is calculated by the formula

$$E_0 = 24{,}5 m\delta\left(1 + \frac{0{,}613}{(r_0\delta)^{0,4}}\right)\kappa B/sm(10^5 V/m),$$

where m is the coefficient of non-smoothness of the wire; δ - relative air density; r_0 is the radius of the components of the split wire or the radius of a single wire, sm.

Radio interference on overhead lines can occur both from corona on wires, and due to partial discharges

and corona on insulators, breakdown or overlap of defective insulators, corona on linear fittings and spacers of split-phase wires, as well as due to sparking in poor contacts of linear fittings, spacers wires and between insulators. Radio interference generated by overhead lines in the frequency range from 0.15 to 30 MHz is normalized at the following distances from the projection of the outermost wire to the ground: for overhead lines 110 and 220 kV - 50 m;for overhead lines 330 kV and above - 100 m.

In the norms of Russia, the frequency spectrum of the permissible values of the field strength of radio interference from overhead lines is given (Fig. 2).

The dependence of radio interference on the maximum electric field strength on the surface of the wires in good weather at $E_м$ = 23÷30 kV/cm has the form

$$E_n - E_n^{'} = 2{,}3 \cdot 10^{-5}(E_m - E_m^{'})dB$$

Where, E_n and $E_n^{'}$ are the levels of radio interference at maximum voltages of the electric field, on the surface of the split wire, respectively, E_m and $E_m^{'}$, V/m.

The dependence of radio interference on the radii of the wires (in the case of a split phase - on the radii of the constituent wires) at E_m=const has the form

$$E_n - E_n^{'} = 40 \lg \frac{r_0}{r_0^{'}}\, dB$$

Where,E_n and $E_n^{'}$ - levels of radio interference at wire radii, respectively, r_0 and $r_0^{'}$.

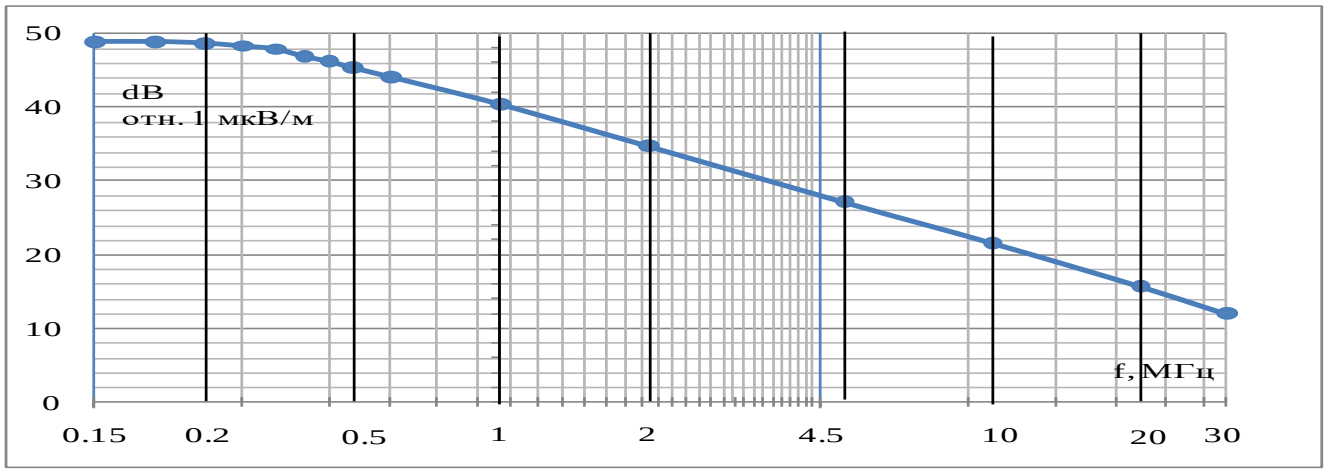

Figure 2. Permissible values of the radio interference field strength

The dependence of radio interference on frequency is determined by the expression

$$\Delta f E_n = 5\,[1 - 2\,(\lg 10\, f)^2]\ dB$$

The shape of the transverse profile of radio interference is determined from the expression

$$E_n - E_n^{'} = 20\, lg \frac{R^k h^{k-1}}{R_1^k h^{k-1}} dB,$$

where f - frequency, MHz; $\Delta_f E_n$ - change in the level of radio interference relative to the level of radio interference at a frequency of 0.5 MHz.

The level of radio interference decreases with distance from the overhead line. On fig. 3 shows the transverse profiles of radio interference for OL 500.

Where, E_n and E'_n are the levels of radio interference, respectively, at distances R and R_1 from the nearest outer wire of the overhead line at its suspension heights at the measurement points h_1 and h_2; k - coefficient of transverse attenuation of radio interference, equal to 1.6.

To calculate the distribution of the level of radio interference during the year, three weather groups are

distinguished: fine weather, rain and dry snow. The levels of radio interference, taking into account the received weather groups, are distributed according to a law close to normal, with a standard deviation σ equal to 4-6 dB.

In rain, the average levels of radio interference are higher than in good weather by 10 dB, and in dry snow - by 6 dB. The percentage of time in year B, during which the level of radio interference does not exceed the permissible value $E_{п}^{доп}$, is determined by the formula

$$B = 100\left[\psi_{y.h.}\Phi^*\left(\frac{E_h^{b.b} - \bar{E}_h^{y.h.}}{\sigma_{y.h.}}\right) + \psi_{h.}\Phi^*\left(\frac{E_h^{b.b} - \bar{E}_h^{y.}}{\sigma_{y.}}\right) + \psi_{q.}\Phi^*\left(\frac{E_h^{b.b} - \bar{E}_h^{q.}}{\sigma_{q.}}\right)\right]\bar{E}_h^{y.}\%$$

Where, $\psi_{x.n}$, ψ_d, ψ_c- relative duration, respectively, of good weather, rain and snow during the year; $\overline{E}_n^{x.n.}$, $\overline{E}_{п}^{д}$, $\overline{E}_{п}^{с.}$ - average values of radio interference levels at a given standardized distance, respectively, in good weather, rain and snow; $\sigma_{x.n}$, σ_d, σ_c - standard deviations of the distribution of radio interference levels, respectively, in good weather, rain and snow; Φ* - normal distribution function.

Determination of the levels of radio interference from overhead lines is carried out in the following order: - for the basic level of radio interference $E_{пб}$ is taken the average value of the levels of radio interference at a normalized distance, determined for a 500 kV overhead line, the maximum field strength on the wires of the overhead line is calculated according to [7] section; calculation the average level of radio interference in good weather at a frequency of 0.5 MHz at a normalized distance of 100 m from the overhead line is produced by the formula (dV)

$$\bar{E}_h^{y.h.} = E_{hb} + 2{,}3 \cdot 10^{-5}(E_m - E_{mb}) + 40\lg\frac{r_0}{r_{0b}} + \frac{H}{300}$$

Where, the field strength $E_м$ is taken for the middle phase; - the value of B is calculated by formula , where for the base frequency of 0.5 MHz, the value

$$E_n^{dop} = 45 \text{ dB (see Fig. 3);}$$

the value $\sigma_{хп}=\sigma_д=\sigma_c$ is taken equal to 5 dB. For power lines with a horizontal arrangement of wires for regions with a temperate climate, the calculation of the permissible values of the maximum field strength E_{dop} on the surface of the wires of overhead lines according to the condition of the permissible level of radio interference is carried out according to the formulas:

for 330 and 500 kV overhead lines

$$E_{dop} = 31{,}1 - 17{,}4\lg r_0 \text{ kV/sm } (10^5\text{V/m});$$

for 750 kV overhead lines E_{dop}=32,2-17,41 lg r_0 kV/sm (10^5V/m)

The level of distributed interference $P_{pom.f}$ in any frequency band (Δf) other than 1 kHz is determined by the formula

$$P_{pom.f} = P_{pom} + 10\lg\Delta f \text{ dB.}$$

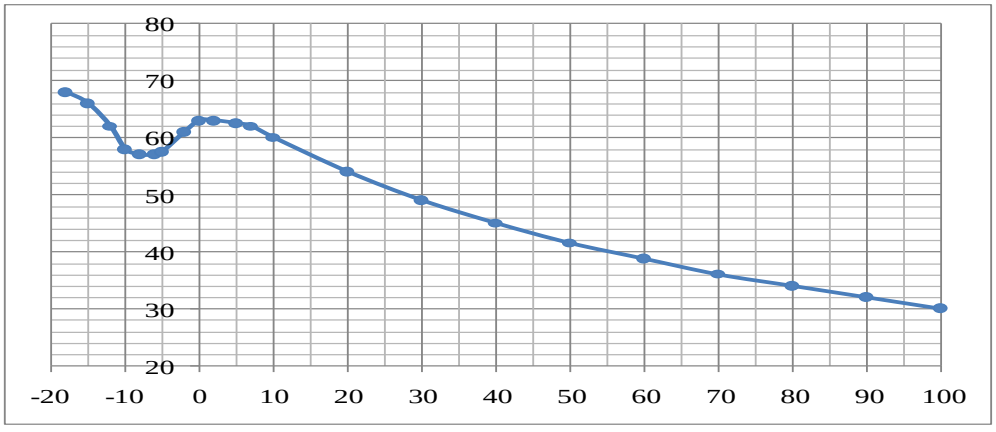

Figure 3. Cross profiles of radio interference from 500 kV overhead lines with wires 3*ACO-500/40

3. Conclusions

Figure 4 shows a screen form for data entry on a 330 kV intermediate support.

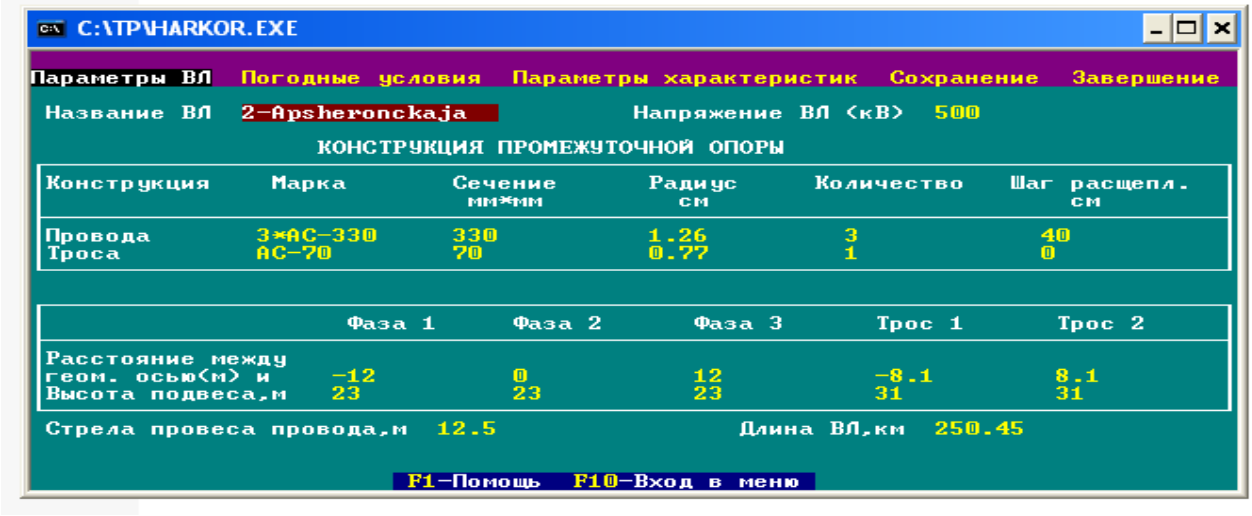

Figure 4. OH support data display form

Results of the 330 kV HX sample program.
EDOP=29.7kV/sm
Voltage OH 330.0 kV
Wire brand ACO-300
Nominal wire cross section 300 mm**mm
Wire radius 1.2 sm Rope radius 0.77 sm
Number of wires 1 cables 1
Wire splitting pitch 0.0 sm Rope 0.0 sm
Distance between wires and geometric axis in m-s
-5.80 4.8 8.30 0.00 0.00
Phase suspension height on the support in m-s
22.5 29.5 22.5 37 0.0
Wire sag in m-s 14.50 m
Wire roughness 0.82
Critical current density 0.00 A/mm*mm
Relative air density 1.05
Average annual air temperature 15 C
Duration of weather type in hours Txп= 7960 Tss= 150 Td= 600 Tkiz= 50 Precipitation intensity DI= 1.00 mm/hour
The calculation is made for mining overhead lines TOX= 1 PB= 1.05 CGT=15.00 BHM= 100.0
Intermediate results
Wire splitting radius 1.20 sm
Equivalent wire radius 0.069 m
Irregularity factor 1.06
Phase capacitances pF/m 10.808 11.35 11.486
Critical corona tension 31.498
Critical corona stress 442.9 kV/sm
The level of radio interference from overhead lines is unacceptable (EMAKC=25.3 > EDOP=29.7 kV/sm

Modeling the actual levels of radio interference at distances from overhead lines. EMC of overhead lines evaluates the impact of high-voltage power lines on the environment in terms of radio interference, acoustic noise, corona losses and electromagnetic fields. It is an all-in-one design and analysis software package available in the industry. All EMC-specific parameters of overhead lines are presented in one main window, which contains a control with several tabs, providing quick access to groups of parameters such as radio interference, acoustic noise, corona loss, atmospheric conditions and conductor surface conditions.

References

1.A.F.Dyakov, others, Electromagnetic compatibility in electric power, M.:Mir: Energoatomizdat, 758p., 2003. https://e.lanbook.com/book/72336

5.F.V.Peak, Dielectric phenomena in high-voltage equipment,Gosenergoizdat, 1934.

https://old-etr1880.mpei.ru/index.php/electricity/article/view/1117

2.G.N.Alexandrov, High voltage Corona discharge on power transmission lines, Energy, 1972.
https://www.dissercat.com/content/sovershenstvovanie-lokatsionnykh-metodov-distantsionnogo-kontrolya-izolyatsii-linii-elektrop

3.M.V.Kostenko, Technique of high voltages. Under the editor, Higher School, 528p., 1973
https://www.studmed.ru/kostenko-m-v-red-i-dr-tehnika-vysokih-napryazheniy_763e74dfbec.html

4.Ch.M.Juvarli, Y.V.Gorin, R.N.Mehtizade, Corona discharge in electro-negative gases. Under the editor.; AN AzSSR, In- t physicist. - Baku: Elm, 143 p., 1988.

6.A.B.Balametov, Coronation of wires VL SVN. Modeling in established modes. Mono-graph. LAP Lambert Academic Publishing, 310 p., 2013.

7.Guiding instructions on the account of loss of the crown and interference from the crown when choosing the wires overhead power lines 330 - 750 kV and constant current 800-1500 kV.-M .: 0GRRES, 1975.
https://files.stroyinf.ru/Index2/1/4294817/4294817291.htm

8.T.M.Lazimov, Theoretical bases of electro-magnetic compatibility and quality of electric power. Lesson funds. Baku, Education NPM, 178 p., 2005.

Current state of hydrogeological conditions of Turyanchay-Goychay foothill plain, efficient use of water resources

I.Sh.Namazov, U.S.Kosayeva, C.B.Nurmammadov

Azerbaijan State Oil and Industry University, Baku, Azerbaijan
nurlan.namaz@mail.ru, kosayeva91@mail.ru, nurmemmedov_ceyhun@yahoo.com

Abstract: One of the most difficult problems of the Republic of Azerbaijan in the South Caucasus, characterized by a shortage of water resources in general and in the near future, is the need to clarify the resources of surface and groundwater in certain regions, taking into account the current state of transboundary rivers. In this regard, it should be noted the importance of studying the current state of the hydrogeological conditions of the Turyanchay-Goychay plain and forecasting for the coming years. It is important to study the dynamics of the cones of the Goychay and Turyanchay rivers with a length of 115 km and 186 km, as well as the main hydrological and hydrogeological parameters of the hydrogeological region, which is a large complex territory as a whole.

Keywords: Hydrogeological area, Imported cone, Groundwater, Confined waters, Degree of mineralization, Chemical composition, Transboundary rivers.

1.Introduction

The relevance of the article is that the Turyanchay and Goychay rivers are the richest rivers in the southern foothills of the Greater Caucasus and play a major role in the development of agriculture and water supply of regional centers and, in part, rural settlements. Physical and geographical conditions in the formation of hydrogeological conditions of the area, relatively large basins of these rivers, hydrological and hydrogeological parameters of the tributaries of rivers are assessed as natural factors.

Hydrogeological conditions in the area of Goychay city depend on the groundwater resources of the Goychay river. The depth of groundwater in the territory of Goychay is very low. This is due to the fact that the geological structure of the area includes impermeable rocks close to the surface, which makes it difficult to feed groundwater due to infiltration of atmospheric sediments.

The fact that the flow passes only through river valleys and ravines is confirmed by the presence of the Goychay river underwater, the groundwater is represented in alluvial sediments and gravel material. The depth of their sleep depends on the level of water in the river. The thickness of the subsurface flow belonging to the alluvial layer is determined by the depth of deposition of Absheron-aged clays.

After Turyanchay, the catchment area of the Goychay River is of exceptional importance in the formation of water resources in the southern part of the Shirvan plain. Thus, both rivers create their import cones first in Ganikh-Ayrichay and then in Shirvan.

Deep groundwater has developed in the deluvial-proluvial zone in the northern part of the area. Depth of groundwater in drilled wells is 20-25 m. The regime of groundwater in irrigation massifs is formed under the influence of complex, natural and artificial factors (atmospheric sediments, evaporation, irrigation water, etc.).

The rise in groundwater level is due to infiltration feeding (due to irrigation and washing water), losses from canals, and underlying aquifers. Evaporation processes play an important role in the period of relative stabilization of groundwater levels.

Depth of groundwater in irrigated lands and the degree of mineralization depends on the efficiency of the irrigation system, irrigation method and regime, the intensity of artificial drainage, which affects the balance of groundwater [2, 3].

In the assessment of irrigation conditions, the acceptable depth of groundwater is determined by the degree of mineralization (maximum accepted limit is 5 g/l), the degree of mineralization of groundwater is formed in the process of rising and dynamics of groundwater levels. Due to the development of

irrigation in recent years, groundwater has softened at a rate of 0.82 g/l per year (average 20.5 g /l).

According to the hydrogeological conditions, 2 pressurized aquifers up to 300-400 m depth were found in the aquifer complexes of the fourth period sediments in Goychay area.

Graphene-based material have exceptional services in the detection of natural water resources [7-9].

The first pressurized aquifer was opened at a depth of 15-130 m in the areas of the Goychay river. It is separated from groundwater mainly by clays with a thickness of 7-90 m.

The piezometric level of the wells was below ground level everywhere before the existing water canal was built. The lithological composition of aquifers varies from river rocks, gravel, gravel to fine and fine-grained sands. In most cases, the aquifers consist of alternating layers. The thickness of these layers varies between 12-13 m and sometimes up to 30 m (Fig. 1).

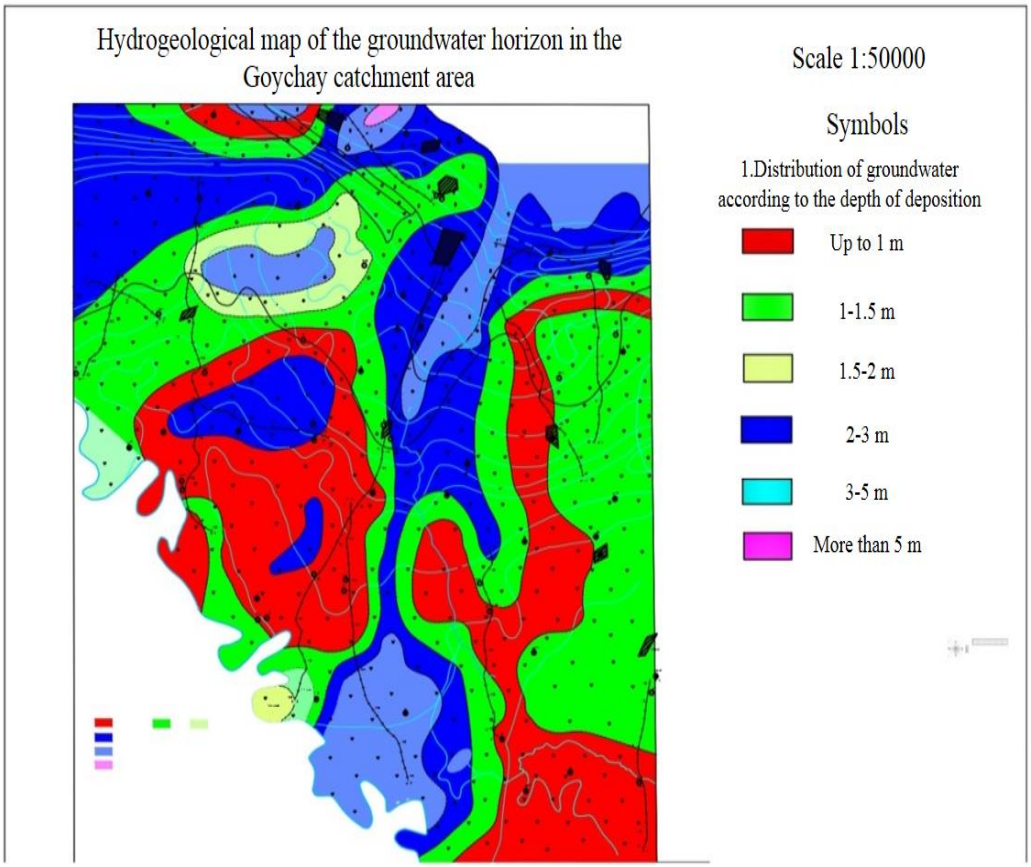

Figure. 1. Hydrogeological map of the groundwater horizon in the Goychay catchment area

The piezometric surface of pressurized water is located below the ground in most parts of the area and is 0.5-22 m. In some areas, the piezometric level of pressurized water in the central part of the delivery cones is above ground level (0.2-10 m).

The mineralization rate of the first pressurized water is between 0.5-70 g / l, and the relationship between the mineralization rate and the chemical composition is given in Table 1.

Table 1. The relationship between the chemical composition of water and the degree of mineralization

Chemical type of water	Water mineralization rate, mg / l
Hydrocarbonate – sodium	<0,5
Sulfate-hydrocarbonate-sodium calcium	0,5-1,0
Sulfate - sodium – calcium	1,0-3,0
Sulfate – sodium	3,0-100
Sulfate-chloride-sodium-magnesium	10,0-30,0

2. Experimental details

The quality of groundwater varies greatly, both in terms of general mineralization and chemical composition. In pressurized water, mineralization increases in the direction of groundwater flow and becomes unusable after the middle parts of the delivery cones, exceeding 3g/l. Suitable pressurized water is found in the upper and middle parts of the delivery cones, as noted. These aquifers belong to the fourth period continental sediments.

Consequences of global climate change, on the other hand, the unequal distribution of water resources throughout the country, it is necessary to gradually assess the current state of the hydrological parameters of the Azerbaijani river. In particular, the additional study and re-evaluation of groundwater formed in the tributaries of rivers is of great practical importance. The slopes of the mountain slopes have bringing cones and plumes. The proluvial rocks collected here have abundant aquifers [4].

Artesian wells were drilled and geological exploration works were carried out in Potu village to reconstruct the drinking water supply system of Goychay city.

The study of physical and chemical properties of groundwater formed in the Goychay river, the feasibility study of the productivity and comprehensive prospects of the drilled well is of great importance in modern times.

To assess the general geological condition of the Goychay and Turyanchay rivers, to study the physical-geographical conditions of the Goychay and Turyanchay river basins, the physical and chemical properties of the water, to evaluate the perspective of drinking and domestic and irrigation groundwater formed in the Goychay and Turyanchay rivers. should be studied.

The Shirvan plain, which includes the survey area, is the largest geomorphological region in the Kur-Araz lowland. The Turyanchay and Goychay rivers consist of inflow cones and sunken inter-conical plains. The cone of the Goychay River covers a large area. Factors affecting the hydrogeological and hydro-chemical conditions of this zone, physical and geographical characteristics of the area (relief, climate, hydrographic network, soil and vegetation), general geological structure (tectonics, seismicity, stratigraphy, geomorphology), etc. depends.

According to the norms for the population of the city or the region as a whole, the norm of water demand and the amount of water consumed by the consumer during a certain period of time are understood. When designing a water pipeline, these rules are taken into account and the amount of water to be supplied by the pipeline and its mode of consumption is determined. Therefore, when designing water supply systems, the population of the area (city, district, settlement, village, etc.) is first specified [5].

The territory of Goychay is 0.75 thousand sq. Km. The population, including cities and villages, was more than 120,000 at the January 1, 2019 census. In addition to Goychay, there are 55 settlements and villages in the region. According to the roadmaps for agricultural development of the regions, 43,000 people are expected to live in Goychay in 2035. In recent years, dozens of additional artesian wells have been drilled around the city of Goychay, and 3 reservoirs with a capacity of 6,500 m^3 have been built.

The territory of Goychay region is bordered by about 26 km from the north to the south and 41 km from the east to the west. The study area borders with Gabala, Kurdamir, Ismayilli, Agdash and Ujar districts.

The length of the Goychay River is 115 km, the area of the basin is 1770 km2. The river passes through Gabala, Ismayilli, Goychay, Ujar and Zardab districts. The name of the region is of Turkish origin and is named after the Goychay River, which is located on its banks. The delivery cones have a convex surface and are fan-shaped at the lower edge. In the upper parts of the inflow cone, the rivers were relatively less interspersed and gravelly sediments were collected.

Accumulation of sand-filled gravel-gravel sediments was observed in the relatively middle part.

Turyanchay - As the left branch of the Kura, it leaves the southern slope of the Main Caucasus Range and flows into the Kura through an artificial canal. The length of the Turyanchay is 180 km, the area of the basin is 1840 km^2, and it starts from the south-western slope of the Bazarduzu range. The average annual flow of the Turyanchay is 15.8 m^3/s. A hydroelectric power station was built on the river, the river junction was cut off by a dam, and below the river water is transferred to 2 canals, thus regulating the flow of the river in the territory of the Shirvan plain. Assessment of groundwater resources of the supply cone (in the territory of Agdash region) determines the nature of their balance and allows to assess the groundwater resources.

The current situation in the country requires that the determination of the balance elements of the ground-water of these rivers (and other major republican rivers) and the calculation of the water resources of the inflow cones be calculated based on the assessment of physical-geographical and geological-hydrogeological characteristics.

Analysis of hydrogeological materials in the area shows that the upper part of the consuls of these rivers consists of hilly structures composed of well-collected sediments. This, in turn, creates very favorable conditions for the formation of groundwater. Here, aquifers often interact to form a single hydraulic system [6].

The role of Damiraparanchay in feeding the groundwater complexes in the area should also be noted. With a length of 69 km and an area of 596 km^2, the river originates at an altitude of 3860 m. Groundwater accounts for 40-60% of the annual flow. The average annual water consumption is 3.10 m^3/s. During the period of intensive irrigation, part of the water is discharged into the Turyanchay and Goychay rivers and is widely used for irrigation.

The main part of the import cones of the Turyanchay and Goychay rivers is covered with modern sediments. These rivers are mainly discharged outside the Shirvan plain, in the Ganikh-Ayrichay valley. Taking this into account, monitoring of exploitation and regime-observation wells located in the Ganikh-Ayrichay basin as a whole should be carried out over a large area [3-6].

On the other hand, the Turyanchay and Goychay rivers precipitate crushed materials in the Shirvan plain. Pebbles are found only in the main river basin, a short distance from the top of the inflow cones, and in some tributaries. In the rest of the cones, clayey-sandy sediments are collected and clays predominate.

In the past, the groundwater reserves of the Turyanchay import cones were set at 158.7 thousand m3 / day, and the groundwater reserves of the Goychay import cones at 98.2 thousand m3 / day. At present, there is a great need to clarify these reserves.

The Upper Shirvan canal, which starts from the Mingachevir reservoir and stretches for 123 km, allows irrigating more than 47,000 hectares. In order to make more efficient use of the river network of Shirvan and the entire foothill plain, water collection facilities were established in the lowlands and other large-scale construction works (KDS, etc.).

3. Conclusions

Additional measures should be taken due to the water resources of the Republic and their management. The regime and balance of groundwater must be organized with new technologies implemented in global countries, and hydrogeological parameters must be specified.

Groundwater resources should be clarified, special regime forecasts for their operation, efficient use, protection from depletion and pollution should be substantiated. Feeding and discharge conditions, assessment of factors and processes affecting individual regimes, regularities of global climate change over time, determination of regularities of groundwater water, salt and heat balance formation and their use for groundwater regime forecasting, irrigation and drainage Substantiation of reclamation, management of the regime in the hydrogeological zones where these measures are taken should be carried out.

Development of different technologies for natural, disturbed and mixed regime of water resources should be carried out to assess the filtration indicators and boundary conditions of aquatic complexes, agricultural production and other economic issues.

In order to prevent soil erosion and protect nutrient microorganisms, it is necessary to establish forest massifs and strips. Due to the growing population of the country, urbanization in cities, increasing demand for water in various sectors of the economy, the upcoming global climate change, the problems of transboundary rivers are now under the control of the state and relevant central authorities. Water resources have been managed with completely new technologies. At present, the problem of fresh water has become a global problem in the world, and its solution is possible through the joint efforts of the countries of the world, especially the South Caucasus republics.

References

1.Geology of Azerbaijan. Hydrogeology. Baku, Nafta-Press. Vol.8, 380 p., 2008.
https://www.researchgate.net/publication/279196165_Geosciences_of_Azerbaijan_Volume_I_Geology

2.Yu.H.Israfilov, R.H.Israfilov, H.H.Guliyev, G.M.Efendiyev, Risk assessment of the water resources losses of the Azerbaijan republic due to climate changes. news of ANAS, Earth Sciences, pp.3-4, 2016.
https://cyberleninka.ru/article/n/prospects-for-using-thermal-water-in-kalbajar-district-and-other-regions-azerbaijan-as-an-alternative-energy

3.V.M.Kerimov, J.J.Sharifov, M.Z.Mammadli, Hydrogeological conditions of the Ganykh-Ayrichay valley, In the book: the development of science and practice in a globally changing world in terms of risks. Collection of materials of the IV International scientific-practical conference, Makhachkala, pp.71-76, 2021.
https://doi.org/10.34755/IROK.2021.46.94.0484

4.I.I.Tagiyev, V.M.Kerimov, J.J.Sharifov, Characteristics of the hydrogeological massifs of the Greater, Lesser Caucasus and Talysh (Azerbaijan) taking into account global climate change, Visnyk of Taras Shevchenko National University of Kyiv: Geology, N 3(94), pp.95-103, 2021.
http://doi.org/10.17721/1728-2713.94.12

5.I.I.Tagiyev, Status and problems of protection of the environment and nature use in the Republic of Azerbaijan, Ministry of Science and Technology of the USSR, 2001.

6.I.I.Tagiev, V.M.Kerimov, Prospects for the development of alternative energy and the use of thermal waters in Azerbaijan, Ural Geolog., Journal 3 (141), pp.51-57, 2021.

7.O.A.Kapush, I.O.Mazarchuk, L.I.Trishchuk, V.Y.Morozovska, S.D.Boruk, S.I.Budzulyak, D.V.Korbutyak, B.N.Kulchitsky, O.G.Kosinov, R.G.Abaszade, Influence of the nature of the dispersion medium on the optical properties of CdTe nanocrystals during sedimentation deposition, Chernivtsi University Scientific Herald, Chemistry (819), pp.7-11, 2019.
https://doi.org/10.31861/chem-2019-819-01

8.R.G.Abaszade, O.A.Kapush, A.M.Nabiyev, Properties of carbon nanotubes doped with gadolinium, Journal of Optoelectronic and Biomedical Materials, Vol.12, №3, pp.61–65, 2020.
https://www.chalcogen.ro/61_AbaszadeRG.pdf

9.S.R.Figarova, E.M.Aliyev, R.G.Abaszade, R.I.Alekberov, V.R.Figarov, Negative Differential Resistance of Graphene Oxide/Sulphur Compound, Journal of Nano Research Submitted, Vol.67, pp.25-31, 2021.
http://dx.doi.org/10.4028/www.scientific.net/JNanoR.67.25

Ecotourism potential of Lankaran region

T.N.Ahmadli, K.R.Yusifova

Azerbaijan University of Architecture and Construction, Baku, Azerbaijan
muharrembeyturan@gmail.com, yusifova.kamala@bk.ru

Abstract: The tourism sector is developing and changing day by day in the historical process from the past to the present. This development and change is also reflected in the types of tourism preferred by tourists and increases the interest in ecotourism. Ecotourism is a sustainable type of tourism that protects the well-being of people and the environment and is sensitive to natural areas. Lankaran region, which has recently become the focus of both the government and investors, has been selected for research due to its general tourism structure, which has been far from tourism for many years. It is seen that religious tourism and rural tourism and many ecotourism activities can be carried out.

Keywords: Lankaran, Ecotourism, Tourism.

1.Introduction

Located on the southwest shore of the Caspian Sea, one of the five ancient and beautiful geographical regions of Azerbaijan, at the confluence of the Lankaran River with the Caspian Sea, Lankaran makes up 7% of the country's territory. The Lankaran region, with an area of 6,070 km2, is bordered by Iran to the south and west and the Caspian Sea to the east [1]. Lankaran Economic Region differs from other regions of Azerbaijan with its natural features and relief. High-value fertile lands and forests covering a large area in the foothills are one of the most important resources of the region. Given the region's water resources, agricultural potential, climate diversity and natural beauty suitable for tourism, it is clear how great the potential of the region is. Lankaran, which is on a trade route, shows the strategic importance of the region [2]. The first period of tourism development in Lankaran dates back to 1960-1990. The second period of development began and continues in 2007 on the basis of the State Project for the Development of Tourism in Lankaran Economic Region. One after another, tourist facilities began to be created. The region occupied an important place among the tourist regions of the USSR due to the climatic features not found in the USSR [3]. The combination of sea, forests, very rare climate and geographical features creates conditions for the rapid development of tourism in this region.

According to tourism experts, in 1974-1987, tourism in Lankaran experienced its heyday. In 1987, due to the increase in the flow of tourists, the construction of a new hotel for 300 people began here. After 1987, there was a great decline in the tourism sector in Lankaran and in Azerbaijan in general, with the processes of disintegration of the USSR, ie "Reconstruction" and the transformation of the Karabakh problem into a war. The events in the country have also affected Lankaran tourism [4].

Among the activities of ecotourism, the protection of nature and the use of nature parks are also important. Nature protection zones have been established in many parts of the world. No other country has as much protected land as Azerbaijan. As a result of research conducted in Lankaran region, the nature of the region is favorable in terms of tourism.

Thermal springs, national parks and summer resorts are the most important ecotourism areas in the region. Tourism activity is developing rapidly in the region, especially the mountain houses built of wood on the Lerik road are a place for those who want to relax in the fresh air. Those who want to get away from the stressful environment of big cities and relax in the oxygen-rich mountain houses come to Lankaran region. Lack of modern accommodation and limited opportunities are among the most important problems in the development of tourism in the region.

The humid subtropical climate and the fact that seven of the world's eleven climate zones are located in this

region indicate that natural-historical tours are developing in the region, one of the most popular types of ecotourism in the region. Such tours are usually organized in parks and national parks. These ecotours can be implemented in Hirkan and
Kyzylagach reserves. A special tourist strip should be built in these areas for ecotourism, and at the same time, individual and collective equipment should be built for ecotourists at the edge of the park [5]. Types of Ecotourism Developing in LankaranMountain adventure tourism - Another type of ecotourism with extensive development potential in the Lankaran economic region is mountain adventure tourism. Talysh mountains are very suitable for this type of tourism. As we know, the most popular tourist destination in modern times is extreme tourism. From this point of view, the development of mountain-adventure tourism in Lankaran is important. However, this type of ecotourism seems more expensive than others. This is because tourists are in danger here. It is not difficult to attract tourists to this area [6].
Mountain tourism-Mountain tourism is the choice of tourists who escape from the fog of the city and settlement, preferring such features as fresh air, water, silence. For the development of high mountain tourism in Lankaran, an equestrian-tourist route must be created. These routes must pass through various relief areas. JalilabadLankaran is one of the regions with the greatest potential for horse tourism
Thermal Tourism-Azerbaijan is called an appetizing place for mineral waters due to the richness of the soil. The most popular (therapeutic) thermal waters in the Lankaran economic region are underground thermal springs. They are located in Lankaran and Masalli. This type of tourism is more developed in these regions. However, in recent years, the lack of opportunities for the development of this type of tourism is one of the important obstacles.
Cultural Tourism - Rich in historical and cultural monuments, Lankaran has the quality of tourism that can enter the international market. Old cities, palaces, mosques, shrines, caravanserais can be considered as tourist attractions of the region. The cultural environment, customs and traditions of this region contribute to the development of cultural tourism in the region. For this, certain reforms must be carried out.
Hunting Tourism - The use of these reserves in areas with rich hunting resources has led to the development of hunting tourism, a type of tourism that attracts tourists. Unlike other types of tourism, hunting tourism is a great source of income. The main reason for this is that tourists interested in hunting tourism are generally rich people. These can be both foreign and local tourists. Hunting farms have been established in many regions of Azerbaijan. The creation of such facilities in the Lankaran economic region will be very useful for the development of hunting tourism.
Maritime Tourism - One of the most favorable types of tourism for the Lankaran economic region is maritime tourism. From May 20, the temperature will fluctuate between 25-280°C. After this time, the temperature rises until the end of August, until September 20, the temperature drops to 25-28°C, and these months are the most favorable time for maritime tourism [7].
Religious Tourism - People living in the Lankaran economic region are loyal to religious customs and traditions. The interest of foreign tourists in such places has been proven in international practice. From this point of view, the development of this type of tourism in the region is inevitable. Public participation in religious tourism is open. Because they demonstrate their traditions and religious views.
Rural Tourism-Rural tourism can be defined as the activity of tourism services provided with beds in rural areas. Lankaran has all the opportunities for the development of rural tourism. Tourists come here to stay in country houses and live real rural life. Rural tourism plays an important role in conveying the customs and traditions, cuisine and other cultural areas of the region. The growing interest of tourists in local traditions encourages local people to gather more information on this topic, as well as to protect the environment.

3. Conclusions

Being a part of the Turkic world, Lankaran Region is one of the important parts of the country with its unique features in every aspect. Along with the protection of natural and cultural heritage, ecotourism has the potential to provide direct or indirect employment to the region's population. The potential of ecotourism in Lankaran is highly valued by public and private sector investors. People need to be informed about tourism. The state should educate the region where people live, its natural and cultural

resources as a source of daily income and not to be indifferent to these values, and create public information programs and projects in this direction. Marketing activities should be carried out in a planned and organized manner, in a coordinated manner, covering the public, private sector and all stakeholders. The promotion of ecotourism in the region should be carried out through the conclusion of contracts with travel agencies and the use of modern marketing methods. In Lankaran region, the duration of the sun is high depending on the latitude effect. Therefore, sea and beach tourism will make a positive contribution to tourism revenues.

Routes of different places where ecotourism activities will be carried out in Lankaran should be determined, the identified routes should be visualized and promoted. The most important element of the stage of determining the potential of tourism destination is the identification of tourism resources of destination. The availability of the resources mentioned in the destination also determines the potential of a place to attract tourists. In order to carry out ecotourism activities in tourist areas, it is necessary to determine the scope of these activities.

References

1.M.Agakerimov, S.Babazade, Excursion and Tour Guide, Oscar Press, Azerbaijan, 2006.
2.S.Mammadova, Ecological Assessment and Monitoring of Soils of Lankaran Province of Azerbaijan, Scientific Publications, Azerbaijan, 2006.
3.S.Huseynov, E.Rich, Tourism in Azerbaijan, Proceedings of the Scientific Conference, Azerbaijan, 2008.
4.M.Abbasov, History of Lankaran, Enlightenment press, Azerbaijan, 2000.
5.M.H.Talishli, B.Huseynbalaoglu, Lankaran, Education Publications, Azerbaijan, 1990.
6.R.Aflatunlu, Agricultural Life in Lankaran Region, Master's dissertation, Turkey, 2002.
7.S.Efendizade, Ecotourism in Azerbaijan and its development prospects, Baku Publishing House, Azerbaijan, 2005.

Algorithm for automatic regulation of pressure-pump station

I.Y.Bayramov, V.K.Kasimov

Azerbaijan State Oil and Industry University,Baku, Azerbaijan
imranb1963@mail.ru, qasimov_16@inbox.ru

Abstract: At present, the oil refinery is a complex complex consisting of various technological facilities. This includes technological facilities that carry out the initial preparation, production, storage, transportation, as well as the export of oil or gas. The sustainability of the oil and gas production process, as well as the spread of the applied technological equipment over large areas, the need to include a pressure pumping station in the automation systems for remote control and monitoring of technological processes and facilities. That is, the goal is to create a system of automation of the pressure pumping station.

Keywords: PID, Driver, Regulator, Pipe, Valve, Price, Process, APCS, Regime, Function.

1.Introduction

In modern times, an oil refinery is a complex of technological facilities with a size of hundreds of kilometers, located in impassable areas, producing, initially preparing, storing, transporting and exporting gas and oil. Modern development of science opens new opportunities [1-10].

The continuity of the oil and gas production process, as well as the spread of technological facilities over large areas, has led to the need to develop and implement automation systems and organizational structures for remote control and monitoring of technological processes and facilities.

Often, one or a group of oil and gas fields do not have enough produced energy to transport a mixture of oil and gas, which is a problem. Therefore, it is recommended to use booster pumping stations (GNS) to eliminate this problem, ie for easy transportation of oil and gas mixture.

GNS equipment, such as pumps, puts extra pressure on gas and oil, which is necessary to transport them to high-pressure parts through collection and treatment systems.

A typical GNS includes the following process equipment: gas separators; oil and gas separators;gas measuring device; pumps for oil and water injection; reservoirs; drainage tanks; sediment tanks; oil measuring device; electric valves; control valves; ovens.

The purpose of the system is to develop an automated process control system for the CSN. TP AIS must provide the following: automated control and management of the real scale of the technological process of the booster pumping station; providing service personnel with operative and reliable information;data collection and transfer to the enterprise database;process security;control of technological parameters (condition of pump units, level, flow rate, etc.);remote and automatic, which makes the technological process safe in case of failures or accidents (failure of technological equipment, fire, etc.).

An example of the pressure at the pump outlet is a regulated parameter in our process. Here, it would be appropriate for us to use the PID management algorithm as a control algorithm. In the example Properial-Integral-Differential system, the main purpose is to generate a single control signal through a feedback circuit in an automatically controlled system. The generated control signal consists of the sum of 3 elements. These elements are the first, second and third proportions. They are, accordingly, the input signal, the integration of the input signal and its derivatives.

The control object is usually part of the pipeline and is located between the regulator and the flow measurement point. The length of this section is determined in accordance with the rules for the installation of regulatory bodies and sensors and is usually several meters. "The flow of matter through the valve - the flow of matter through the flow meter" means the dynamics of the channel. The dynamics of the channel itself is described as a first-degree

aperody transition or first-degree delay. The delay time is generally a few seconds for any liquid.
The transmission function for the adjustable volumetric flow rate of the pipeline will be as follows:

$$W(s) = \frac{Q_k(s)}{Q(s)} = \frac{1}{Ts + 1^{e^{-t_0 st}}}$$

$$T = \frac{2Lfc^2}{Q}$$

$$\tau_0 = \frac{Lf}{Q}$$

$$c = \frac{Q}{f}\sqrt{\frac{\rho}{2\Delta\rho}}$$

$$f = \frac{\pi d^2}{4}$$

Accordingly here:
$Q_K(s)$ - fluid flow after the valve;
Q (s) - velocity of the fluid flow measured:
T - time;
L is the length of the pipeline between the adjustment and the measuring point;
f - length of the intersection area;
ρ - density of the liquid;
d - diameter of the pipe;
t – delay.
The characteristics of the control object are shown in Table 1.

Table 1 - Features of the control object.

Number	Parameter	International units	Price (Quantity)
1	The length of the pipeline	M	6
2	Distributed pressure along the pipeline	MPa	1,5
3	Density of oil	kq/m^3	900
4	The diameter of the pipe	Mm	300
5	Volumetric flow rate of fluid in the pipe	km/h	750

The transfer function for the control object will be calculated as follows according to the parameters specified in the table.

$$T=\frac{LQ}{f} \times \frac{\rho}{\Delta\rho} = 0{,}45$$

$$\tau_0 = \frac{L}{Q} \times \frac{\pi d^2}{8} = 0{,}7$$

$$w(s)= \frac{1}{Ts + 1\ e=0{,}7s}$$

If we look at the model we will describe below, the regulator is described using a closed feedback circuit. This chain has a first-class aperodic switch (electromechanical component), then a Rate Limitter connection that limits the speed of the signal, and finally an integrator and a limiting switch that converts the speed to the angle of displacement.

2. Experimental details

The system consists of two circuits. These are the direct closed and direct external control circuits of the electric drive. A diagram of the system managed in the MATLAB program is shown in Figure 1.

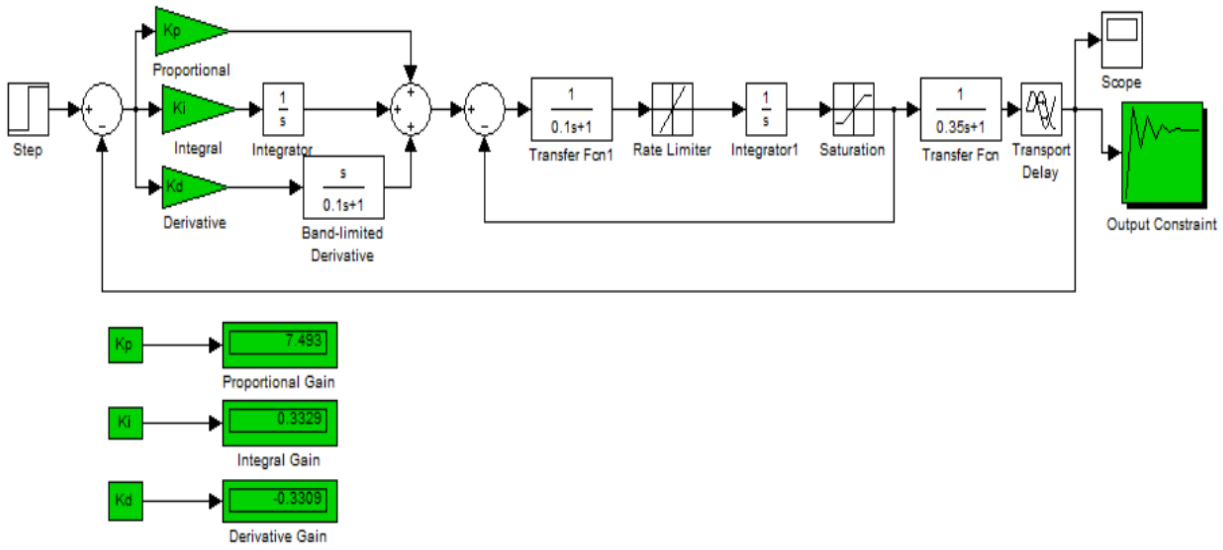

Figure 1. Model of the system in MATLAB program

3. Conclusions

Automatic adjustment of the regulator was performed using the output capabilities. This obtained the transition process shown in Figure 1. For the resulting transition process, we can show a graph of the process that is configured by the PID controller using the MATLAB software package in Figure 2 below.

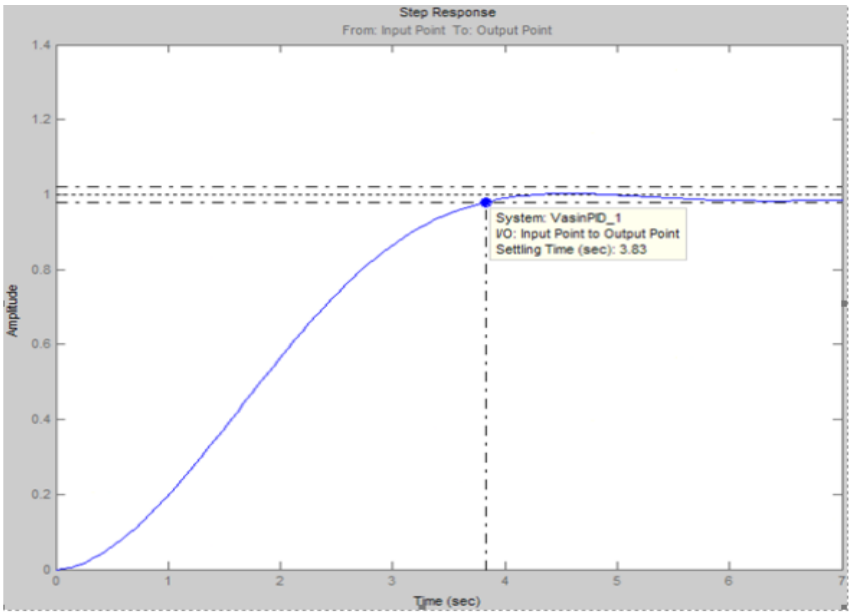

Figure 2. Schedule of the transition process

References

1.R.G.Abaszade, Analysis of carbon nanotubes, AJP Fizika, Vol.26, №2, section: Az, pp.25-29, 2020.
http://www.physics.gov.az/physart/256_2020_02_25_az.pdf

2.S.R.Figarova, E.M.Aliyev, R.G.Abaszade, R.I.Alekberov, V.R.Figarov, Negative Differential Resistance of Graphene Oxide/Sulphur Compound, Journal of Nano Research Submitted, Vol.67, pp.25-31, 2021.
http://dx.doi.org/10.4028/www.scientific.net/JNanoR.67.25

3.R.G.Abaszade, O.A.Kapush, S.A.Mamedova, A.M.Nabiyev, S.Z.Melikova, S.I.Budzulyak, Gadolinium doping influence on the properties of carbon nanotubes, Physics and Chemistry of Solid State, Vol. 21, No. 3, pp. 404-408, 2020.
https://doi.org/10.15330/pcss.21.3.404-408

4.R.G.Abaszade, O.A.Kapush, A.M.Nabiyev, Properties of carbon nanotubes doped with gadolinium, Journal of Optoelectronic and Biomedical Materials, Vol.12, №3, pp.61–65, 2020.
https://www.chalcogen.ro/61_AbaszadeRG.pdf

5.RMG 62-2003 State system of ensuring the unity of measurements. Ensuring the effective-ness of measurements in the management of technological processes. Evaluation of deficien-cies in measurements with limited source infor-mation. - M .: Standardinform, 2008.

6.O.A.Kapush, I.O.Mazarchuk, L.I.Trishchuk, V.Y.Morozovska, S.D.Boruk, S.I.Budzulyak, D.V.Korbutyak, B.N.Kulchitsky, O.G.Kosinov, R.G.Abaszade, Influence of the nature of the dispersion medium on the optical properties of CdTe nanocrystals during sedimentation deposition, Chernivtsi University Scientific Herald, Chemistry (819), pp.7-11, 2019.
https://doi.org/10.31861/chem-2019-819-01

7.SanPiN 2.2.2.542-96 "Hygienic requirements for video display terminals, personal electronic counting machines and work organization".

8.GOST R MEC 61508-6-2012 Functional safety systems of electrical, electronic, programmable electronic, associated with safety. Part 6. Guidance on the application of GOST R MEC 61508-2 and GOST R MEC 61508-3.-M .: Standardinform, 2014.

9.R.A.Namazov, R.G.Abaszade, Properties of graphene based solar panels (review), Ecoenergetics, №1, pp.3-8, 2022.
http://ieeacademy.org/wp-content/uploads/2022/05/ECOENERGETS-JOURNAL-No1.-2022.pdf

10.R.G.Abaszade, S.A.Mamedova, F.H.Agayev, S.I.Budzulyak, O.A.Kapush, M.A.Mamedova, A.M.Nabiyev, V.O.Kotsyubynsky, Synthesis and Characterization of Graphene Oxide Flakes for Transparent Thin Films, Physics and Chemistry of Solid State, Vol.22, №.3, pp.595-601, 2021.
DOI: 10.15330/pcss.22.3.595-601

Analysis of the potential for use of floating PV power plant in Masazir

F.G.Aliyev, N.A.Zohrabbayli

Azerbaijan Architecture and Construction University, Baku, Azerbaijan
president@ieeacademy.org, info.nurana@gmail.com

Summary: Recently, the technology of floating photovoltaic panels has demonstrated several advantages over land installations, including faster deployment, less maintenance cost, and higher efficiency. This paper depicts the conceptual model for the FPPP usage that could be installed on the nearby the lake against the pollution of Masazir.

Key words: Masazir lake, Absheron Peninsula, Floating photovoltaic panels, Renewable energy, Conceptual model, Control model, State-and-transition model, Water evaporation, Water pollution.

1.Introduction

Approximately 40% of the population in Azerbaijan and 70% of the industrial potential are located in the Abseron peninsula. Moreover, Absheron peninsula has more 200 lakes with a total area 3325 hectares, which are the subject to 41,5 mln. cubic meters of discharged waste waters. The impacts of these lakes on the environment include the degradation and salinization of the soils, the flooding of additional land areas as a result of the level rise, the destrcutrion of hydrocarbons and other harmful substances not the all media of environment, destruction of settlements, facilities roads and communication lines. There are 5 (small-big) lakes in Masazir village: Masazir salty lake; Gir lake; Gotur lake; Zeli Lake.

The lake located in front of the Lachin cemetery

Masazirsalt lake is located in 21 km of the north-west direction of the Baku, 6 km from the coast of the Caspian Sea, between Masazir, Novkhani, Saray. Masazirsalt lake has ellipsis shape and its area is 1000 ha. The length of the Masazirsalt lake is 4,7 km and the average length is 2,1 km, average depth is 6 m. The length of the lake's coastline is 14 km, the volume of water is 6.8 mln m^3. Masazir lake is fed by rainwater, ground waters and sewer from Masazir and Novkhani villages. In summer the water level decreases with evaporation. Level change is 65-75 sm. There is a salt extraction started from 1813 on a regular basis. Sewer flows into Masazir lake from Masazir village by three flows; from Novkhani village sewer flows by 5 directions in different sizes. There are photos of the sewer flowing into the lake are taken from Masazir village.

The relic lakes such as Beukshor, Ganligel, Bul-Bula, Masazir and Mirzaaladi, are polluted with high concentrations of oil and oil products, phenols, detergents and surfactants. Biochemical changes feature high concentrations of ammonia nitrogen, nitrites, phosphates, ammonia, with a clear risk of eutrophication. Oxygen content in the lakes also is not satisfactory. Important sources of pollution include oily and produced wastewaters, sewage of oil processing and gas processing factories that concentrate in many ponds and reservoirs.

The main purpose of this paper provide conceptual models for reducing negative consequences of pollution factors and diminish the risk factor (Control Model and State-and-Transition model) in the example of Masazir lake of Absheron peninsula.

Description of targeted area

The lake is elliptical and covers an area of 1,000 hectares. The water of the lake is pink, with an average depth of 0,6 m and a water capacity of 6.8 million m^3. During the summer months, the level of the lake drops significantly due to evaporation. Since 1813, salt has been regularly extracted from this lake.

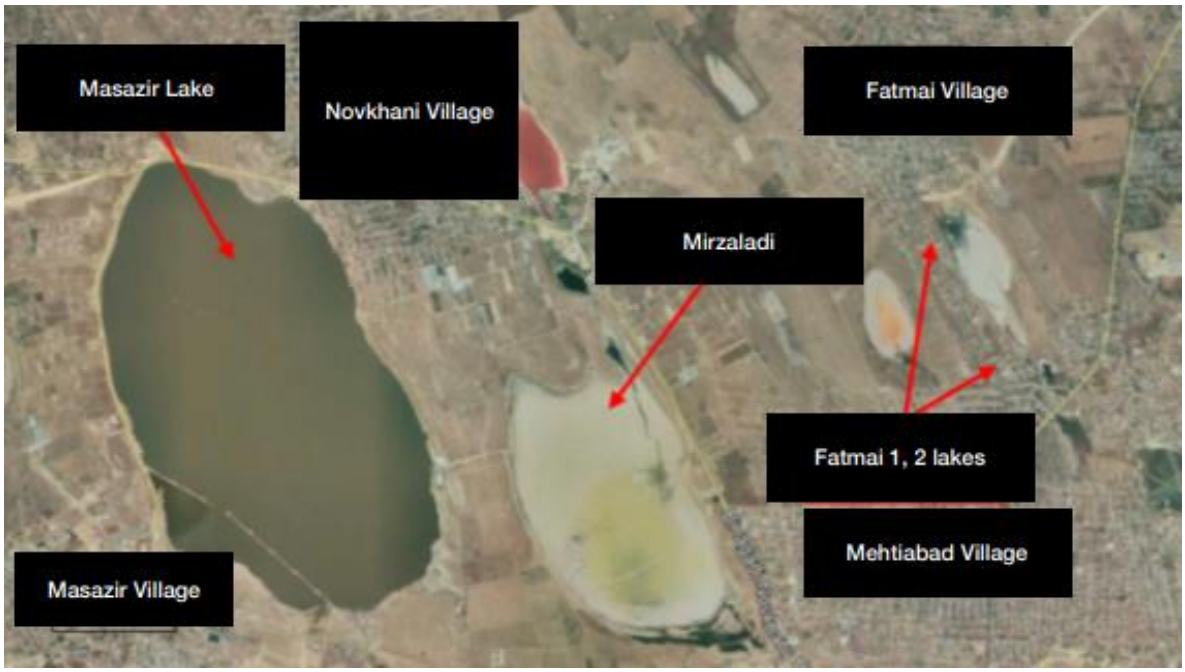

Figure 1. Map of the targeted area

A new salt production facility has recently been commissioned here.

Unlike other Absheron lakes, the salt of Masazir Lake is distinguished by its purity and whiteness. At the bottom of the lake, the salt layer is mostly located in the south and southwest of the lake, near Masazir. Masazir has been known as a source of salt for many years. From the point of view of location, this lake is more convenient than others, so salt production is more intensive here.

Lake Masazir is mainly fed by rainwater and sewage. The lake is subject to level changes. In summer, the lake level drops due to evaporation, and in winter it rises due to precipitation.

The main pollution of water, sediments and soil of the nearby area is caused by sewage, metals, semi-volatile and heavy organic compounds in Masazir and Novkhani villages. Sources of pollution are old oil rigs and nearby industrial facilities. In the summer months the wastewater capacity is approximately 1,800 m^3/day.

The lake is mainly fed by sewage and small lakes in Binagadi settlement. To the west of the lake, sewage and groundwater from new settlements flow into the lake. The discharge of sewage and industrial water from the village of Novkhani feeds the lake from the north.

The number of Ca_2 +, Mg_2 + ions, Cl-ions, ammonium ions in biological substances, oil and oil products is higher than normal. Due to the mineralization of the water, Lake Masazir belongs to a saline group of lakes. The ionic composition of water is dominated by chlorides and sulfates. Concentrations of cesium and cadmium are high. Despite the relatively low level of detergents and petroleum products, their concentrations were several times higher than the GVA. The waters of Lake Masazir are highly polluted. Domestic municipal water with a capacity of 8.5 thousand m^3 from 8 settlements is discharged into Masazirsalt lake (3.5 m^3/day from Masazir settlement and 5 Novkhani settlements).

To the south of the lake is a landfill for household and industrial waste. It was partially lit during the inspection of the area. In addition, new buildings are located near the southern side of the lake, where wastewater is discharged directly into the canal connecting Lake Masazir and Lake Binagadi.

Table 1. The amount of pollutants in the sediments of Lake Masazir

Samples	Phenol (mg/kg)	Surfactants (mg/kg)	Oil and Oil Products (mg/kg)	Concentration of heavy metals (mg/kg)						g/ kg		
Bottom Samples	12	0,17	1725	Zinc (Zn)	Lead (Pb)	Nickel (Ni)	Chromium (Cr)	Copper (Cu)	Cadmium (Cd)	Manganese (Mn)	İron (Fe)	Aluminum (Al)
				24,7	4,6	22,7	20,4	4,2	0.04	202	33.1	23.3
Maximum permissible limit	-	-	100	23	32.0	4.0	6.0	3.0	3.0	1500	-	-

Table 2. The amount of pollutants in the sample of Lake Masazir water

Samples	Phenol (mg/kg)	Surfactants (mg/kg)	Oil and Oil Products (mg/kg)	Concentration of heavy metals (mg/kg)						G/ kg		
Water Samples	21	1,10	0,08	Zinc (Zn)	Lead (Pb)	Nickel (Ni)	Chromium (Cr)	Copper (Cu)	Cadmium (Cd)	Manganese (Mn)	İron (Fe)	Aluminum (Al)
				0,48	0,96	2,20	0,09	4,23	0,04	2,02	32,15	45,53
Maximum permissible limit	1	0,1	0,05	1000	30	100	100	1000	1	100	300	500

2. Experimental details

Legislation of the energy sector of Azerbaijan

Azerbaijan's oil and gas production proceeds to maintain the country's economy and energy supply, providing most of its exports and government revenue. Azerbaijan as a country that is heavily dependent on hydrocarbon export has recently been pledged to reduce GHG emissions to net-zero by mid-century, supplementing an extra element of uncertainty to the long-term economic outlook.

To respond to a wide range of challenges in the energy sector, there are proposes several ways it can make both its energy supply and consumption more efficient and diverse (e.g. Azerbaijan transition gradually from its current system – which is government-owned and -operated, vertically integrated, and subsidised – to competitive markets with significant private sector participation and cost-covering energy prices).

However, the withdrawal of subsidies could be accompanied by support measures for the country's economically vulnerable citizens. Such a transition could potentially appeal to new market entrants and new investments, also for developing Azerbaijan's significant solar and wind energy resources, thereby will lead to the limit of greenhouse gas emissions.

Amid significant legislation, measures could be mentioned is the Law on "Alternative Use of Energy Resources and Energy Efficiency" which was adopted on 20th August 2021. As a result, the previous law named Law on "Use of Energy Resources" were being invalidated.

The main purpose of the adopted law is to regulate relations in the field of production, storage, transmission, distribution, sale, and consumption of energy. This law applies to government agencies, individuals and legal entities operating in the energy sector, as well as consumers. A number of fundamental changes have been made under the new law.

Market Potential. The ongoing interest in solar PV technology can be ascribed to a couple of reasons as follows:

- Simplicity and reliability
- Scalability
- Low costs
- Availability
- Minimum environmental impacts

Despite the aforesaid superiorities, there are two main challenges for solar PV technology which considerably limit these systems to become

widespread. The first handicap is "land use" as about 15,000 m2 of land is necessary to install a 1 MW solar PV plant. The second challenge is "low incentives" since the PV market suffers from not being able to compete with the other RES because of the low incentive rates. In this respect, alternative solutions are considered for solar PVs to be ready to overcome the said drawback in practice. Floating PVs (FPVs) is such an answer which will be considered as a replacement concept of harnessing solar power . FPVs have more competitive advantages in countries with scarce or expensive land for installing land-based photovoltaics (LBPVs). To be able to consider FPV systems as an alternative to land-based PVs, abundant and convenient water resources are required to be available in the region for the installation of FPVs. It is emphasized within the literature that water losses in any resource thanks to evaporation occurring from water surfaces are often considerably decreased through using FPV. Not only that, but the energy performance of FPV is reported to be quite higher compared with LBPVs. Therefore, this research aims at remarking the pros and cons of deploying FPV systems to water bodies in terms of energy generation potential and environmental aspects. From now of view, comprehensive comparisons between FPV and LBPV are done within the scope of several performance parameters like energy production, carbon and water saving, and the quality of water basins when covered with FPVs.

Solar PV Systems .Solar electricity based on PVs has an expanding range of applications especially over the last two decades. In this regard, it is useful to classify the installations of PV systems as the goal of this section.Solar PV applications can be split into five commonly known groups:

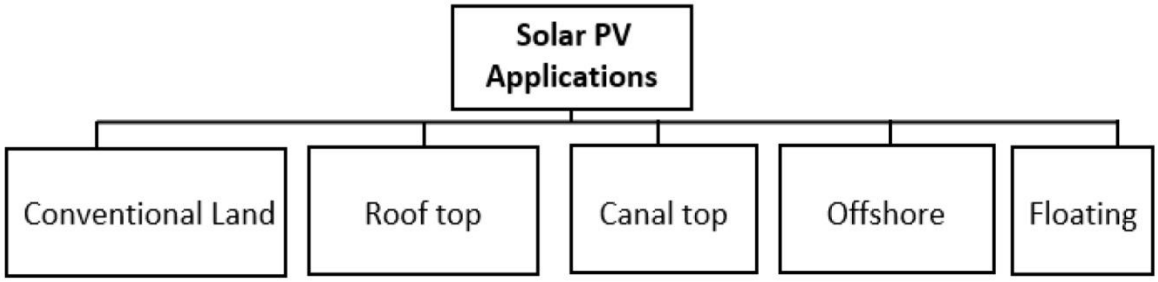

Figure 2. Types of solar PV installations

Technological Overview.Conventional Land-Based Solar PV Applications Installation of PV systems on lands for little, middle, and enormous scale electricity generation purposes is that the commonest understanding of solar PV applications. LBPVs are often basically described as mounting PV arrays ashore at a particular DC power capacity to be ready to achieve a target AC power. The solar modules of PV arrays are fixed within the ground by land-based mounting equipment like pole mounts, foundation mounts, and ballasted footing elements.

Roof Top PV Applications.PV systems can be integrated into residential or commercial buildings as a roof or facade application to generate electricity. The electricity generated are often consumed both on-grid and off-grid. Roof-type PV systems are usually preferred in rural areas where access to the facility grid is difficult or expensive. The area covered by rooftop PV systems is quite small compared with ground-mounted PV applications. In addition, LBPVs show higher electricity generations in contrast to the rooftop, depending on the installed power capacity.

Canal Top PV Applications.Canal top PV systems are installed above the water canal not to occupy the large scale of land area as shown in Figure 5. These systems operate more efficiently than LBPVs thanks to the continual cooling effects through the rear surface of PV modules. The air medium beneath the PV modules acts as a thermal insulator and prevents them from warming up by mitigating the thermal effects from the bottom. Canal top PV systems also contribute substantially to the utilization of the land areas efficiently.

Offshore Solar PV Applications.Oceans account for quite two-thirds of the planet. Oceans and seas are often considered as potential sources of energy due to receiving huge amounts of radiation.For this reason, these water resources are wont to generate electricity

by utilizing offshore solar PV technologies. By the means of those applications, agricultural land isn't required to be destroyed unless compulsory.

Floating PV Applications. Among the solar PV applications, floating systems draw attention year after year as a consequence of remarkably better energy generation performance and outstanding environmental effects. A typical FPV system are often defined because the solar PV arrays installed on the water basin surfaces like hydropower plants, freshwater, and human-made reservoirs, mining ponds, water treatment facilities, near the coast of seas or oceans FPV systems can be designed in different ways for different purposes. However, the most system components are almost an equivalent as follows: PV modules, inverter, floats or pontoons, mooring systems, and cables. The components of FPV are clearly demonstrated in Figure 3.

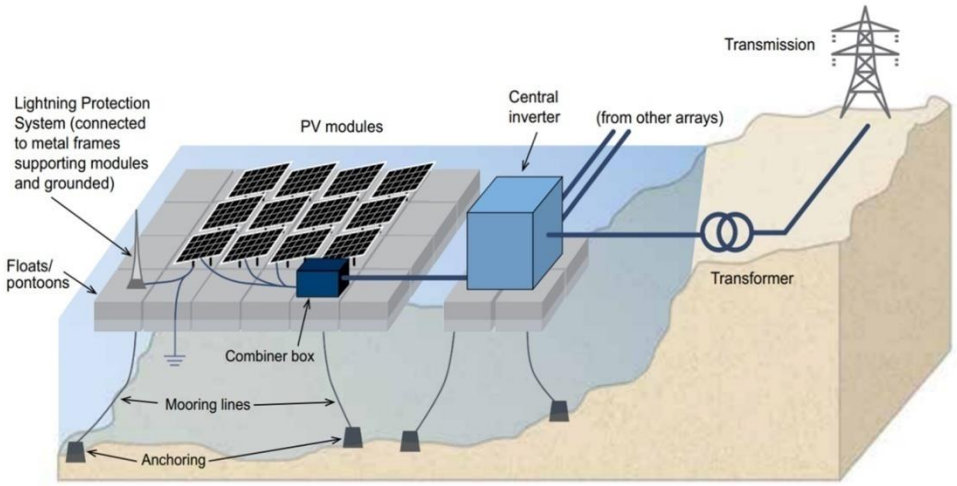

Figure 3. Components of FPV

Factors for technical feasibility of FPV. Performance of the FPV system is observed depending on the different factors namely:

size of modules, phase change material (PCM), floating and support structure;

construction of modules (single or multilayer), e.g. the thickness of modules;

The temperature of modules and inclination of modules which is optimal (Bahaidarah et al. 2013). Additionally, the technical and economic feasibility of the system can be assured by assessing weather conditions, water depth, solar radiation distribution, solar pathfinder, flow modelling, system connection and connectivity with the power system and by determining a mooring method to ensure the adaptation of buoyant materials to substantial changes in water level (Ueda et al. 2008).

One of the technical advantages of FPVS is considered by the use of two microencapsulated phase change material layers on the backside of the PV panels.

The output of energy generation increased by 1.48% with two 3-cm-thick MEPCM layers of melting point 30°C and 26°C, respectively, while the power generation yield of two 5-cm-thick MEPCM layers enlarged by 2.03% during summers at 30°C and 26°C due to the effects of MEPCM layers on the temperature control of PV cell and energy production efficiency of PV unit during the day (Ho et al. 2015). Interest and present discussions on this technology, mostly in Asia, predict larger installations in near future.

Economic feasibility of FPV

The cost of building the supporting floating structure can represent up to 25% of the total project cost and is often less than buying and preparing the equivalent area of land, i.e., civil works and seismic proof foundations.

• They can be installed with ease as no heavy equipment is required (Choi et al. 2013). The amount of steel structures in plant is also reduced because no boilers and chimneys are required in FPV. The PV panels can also be mounted on a rigid pontoon structure. As a result, cost of implementation is not much.

Operation and maintenance cost of FPVS is comparatively less compared with land-based systems as water for cleaning is available at source and components were less likely to overheat. Saltwater corrosion is not normally a problem since most floating PV is sited on freshwater bodies such as lakes and reservoirs. Floating PV is potentially less prone to shading, and there is no maintenance associated with clearing away ground-based vegetation (Smyth et al. 2011)

Shetty and Kulkarni (2014) have calculated the payback period of 5 years for 1 MW Floating Solar Power Plant (PSPP) with 4000 modules of capacity 250 each with minimum plant life of 25–30 years and highlight its economic feasibility. Total installation cost taken was crore 8; selling cost per unit Rs/ kWh 9; total generation hours 1920; total generation (MU) MU/per day 0.008; earning per year crore 1.728, hence providing savings after 10 years crore 9.28.

On the basis of construction materials, cost analysis for constructing FPVS of power 1 MWp was performed by Kim et al. (2017). It was concluded that investment costs were significantly lower for lighter structures made of fiberreinforced polymer. Investment costs will drop with the growth of total installed capacities as well of unit power.

3.Conclusions

Effect on the environment: FPVS can conserve land for agriculture, mining, tourism and other landincentive activities and is an environment-friendly technology with less impact on land (Sahu et al. 2016); Vladan and Zeljko (2017) concluded from their detailed study that FPVS contributes significantly to the reduction in carbon dioxide gas emissions by 83.42 kt CO2/year; The algae formation in the water bodies is also decreased due to reduced rate of photosynthesis in water (Woody 2011); Reduction in the evaporation and more retained water would be beneficial for animals and vegetation in the area where FPV panels are installed; Ecosystems of flora and fauna can be affected (Gair 2014/2015). Biodiversity can get affected as underwater electric cables can affect aquatic ecosystems. Fishing and other transportation activities can be hampered. However, more research is needed to predict the effects of FPV panels on animal life (Sahu et al. 2016); Vladan and Zeljko (2017) concluded that considering the proposed Floating Photovoltaic Power Plant planned on an isolated and shallow part of Skadar Lake whose water level in the summer months decreases to a critical height that isolates it from the rest of the lake, the effect of evaporation reduction has a very positive effect on the survival of living organisms in this part of the lake.

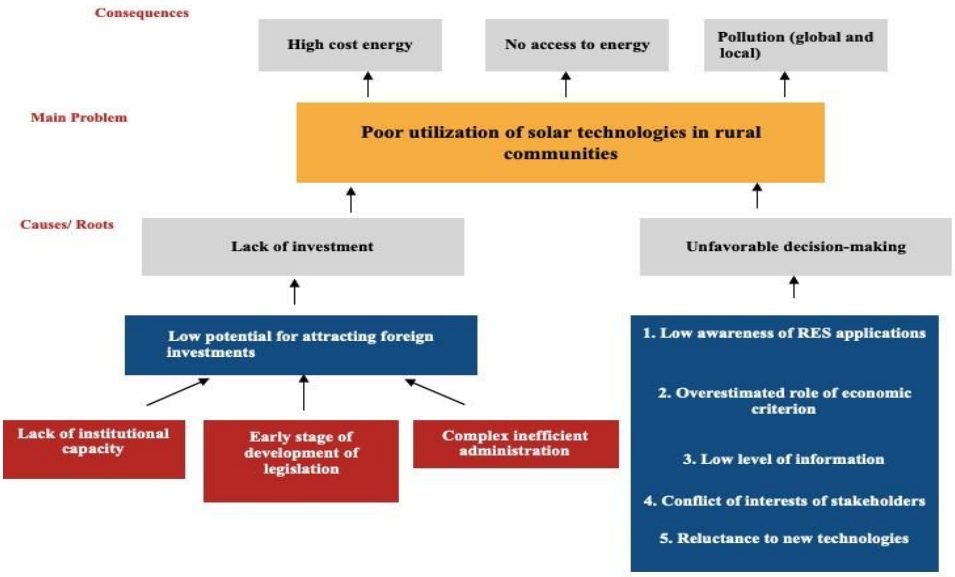

Figure 4. Solar diagrams

References

1.K.Trapani, M.R.Santafé "A review of floating photovoltaic installations: 2007– 2013" https://www.researchgate.net/publication/260410944_A_review_of_floating_photovoltaic_installations_2007-2013

2.IRENA. End-of-Life Management: Solar Photovoltaic Panels International Renewable EnergyAgency, 2016. Availableonline:http://www.irena.org/DocumentDownloads/PublicationsIRENA_IEAPVPS_End-ofLife_Solar_PV_Panels_2016

3.M.D'heur, Sustainable Value Chain Manage-ment; Springer International Publishing: Cham, Switzerland, 2015.https://link.springer.com/book/10.1007/978-3-319-12142-0

4.P.Fontaine, S.Lysine, W.Maes, The evolu-tion of the most important research topics in organic andperovskite solar cell research from 2008 to 2017: A bibliometric literature review using bibliographic coupling analysis, Sol. Energy Mater. Sol. Cells, 207, pp.110325, 2020. [CrossRef]https://www.researchgate.net/publication/337945780_The_evolution_of_the_most_important_research_topics_in_organic_and_perovskite_solar_cell_research_from_2008_to_2017_A_bibliometric_literature_review_

5.Azerbaijan Energy Policy Review https://www.euneighbours.eu/sites/default/files/publications/202107/Azerbaijan2021EnergyPolicyReview.pdf

6.National Sustainable Energy Action Plan of Azerbaijan https://unece.org/fileadmin/DAM/project-monitoring/unda/16_17X/E2_A2.3/Action_Plan_of_Azerbaijan-new-03.12.2019.pdf

The place of the agricultural sector in the economy of Azerbaijan

T.N.Ahmadli[1], X.A.Balayev[2]

[1]Mugla Sitka Kochman University, Mugla, Turkey
[2]Lankaran State University,Baku, Azerbaijan
muharrembeyturan@gmail.com, balayevxeyyam8@gmail.com

Summary: This study emphasizes the importance of agriculture in the Azerbaijani economy. From the past to the present, radical changes have taken place in agriculture. In recent years, the rural population has declined sharply, and this migration has led to a large increase in the urban population. Productive people have become consumers in urban life. While the relative importance of the agricultural sector in the country's economy has been declining, the relative importance of the services sector has increased. It must produce products that are self-sufficient and able to compete with developed countries such as the United States in agricultural-based industrial products and must develop a roadmap for this.

Key words: Azerbaijan, Agriculture, Economy, Agrarian sector.

1.Introduction

Azerbaijan is a very favorable country for agriculture in terms of climate and soil structure. Most of the agricultural activities in Azerbaijan are carried out in the regions around the Kura and Araz rivers. The country has very favorable natural conditions for the production of food for the population. Soils and climatic characteristics indicate that the current and future population has the potential to meet food needs. As in all countries, the agricultural sector in Azerbaijan contributes to the country's economy in various ways.

The contribution of agriculture to the population,
The contribution of agriculture to the labor force,
The contribution of agriculture to the nutrition of society
The contribution of agriculture to GDP
The contribution of agriculture to foreign trade comes to the fore
The development of agriculture in Azerbaijan has been as strong as overall economic growth. Indeed, agriculture can even be seen as a "leading sector" in GDP growth in Azerbaijan.

Table 1. Population of Azerbaijan by years

Census years	General population	The village population	City population	Rural population ratio (%)	City population ratio (%)
2005	8447400	4024000	4423400	47.64	52.36
2010	8997600	4222700	4774900	46.93	53.07
2015	9593000	4494700	5098300	46.85	53.15
2020	10067100	4755100	5312000	47.23	52.77

Source: State Statistics Committee

Looking at the rural-urban population ratios in Azerbaijan between 1990 and 2020, these figures appear to be very close to each other, but between these years Azerbaijan's rural population has increased (2.6%) and the urban population has decreased (2.2%) was observed.
The contribution of agriculture to the labor force - The agricultural sector makes a significant contribution to the country's economy in terms of

employment. Thus, the highest share of total employment in Azerbaijan is occupied by the agricultural sector. The agricultural sector is followed by industry and construction. Between 2008 and 2019, the share of the total labor force in the agricultural sector decreased by 6% in its share of employment, but maintained its leading position among other sectors [1].

The contribution of agriculture to the nutrition of society Over the years, along with economic conditions and other factors, advertising, new products on the market and global fast food (fast food) also affect the nutrition of society. These changes cause nutritional problems and can affect public health.

Table 2. Productivity of agricultural crops, by economic categories Sent / ha

Years	Cereals and legumes	Cotton	Tobacco	Sugar beet	Sunflower for grain
2017	29,8	15,3	16,6	316	20,1
2018	30,0	17,6	19,0	350	20,6
2019	32,1	29,5	19,3	328	21,6
2020	31,8	33,6	22,1	512	22,4

Source: State Statistics Committee

Table 3.Sown areas of agricultural crops, by all categories of farmsmin/ha

	2017	2018	2019	2020
Total sown areas	1665,7	1738,0	1717,1	1630,9
Cereals and legumes - total	977,2	1083,1	1072,3	989,1
Technical plants - total	180,9	159,0	130,2	122,0
Potatoes, melons and vegetables - a total	151,5	149,7	147,7	143,6
Fodder plants	356,1	346,2	366,9	376,2

2. Experimental details

As in the rest of the world, grain is the main source of crops in Azerbaijan. Wheat and barley are in the first place in the grain group in terms of area under crops. In 2017-2020, the productivity of grain crops increased by 98.7%, wheat has a special weight in the structure of the crop. Thus, in 2021, wheat was planted on 595,000 hectares in the country, which is about 40 percent of the total sown area. In general, the area under wheat increased by 1.1 percent compared to last year. According to preliminary data, the country's wheat production in 2021 amounted to 1.9 million tons, which is an increase of 1 percent compared to the same period last year [2].

According to the latest food balance data prepared by the State Statistics Committee (for 2020), Azerbaijan's annual wheat demand is about 3.5 million tons. The country's self-sufficiency in food wheat is 57 percent, which suggests that part of domestic demand is met through imports. In general, in recent years, Azerbaijan imports more than 80 percent of its wheat from Russia.

Among the technical crops, cotton, sugar beet and sunflower are in the first place according to the size of the sown area. During the Soviet era, cotton production increased by 1 million tons per year. In 2015, cotton production decreased to 35,000 tons. As a result of support policies implemented in recent

years, especially in cotton, cotton production increased to about 55.33 thousand tons in 2021. Sugar beet and sunflower production began to be widely implemented in 2000. However, in a short period of time, an increase in the production of both sugar beet and sunflower was observed. Between 2000 and 2021, sugar beet production increased by 370% and sunflower production by 790%.

When studying the development of livestock in Azerbaijan, according to the State Statistics Committee of Azerbaijan, between 1990 and 2021 there is a significant increase in both the number of cattle and sheep, as well as total meat and milk production. Today, the country's companies produce more than 15 types of dairy products (yogurt, cheese, milk, etc.). Although Azerbaijan meets its own demand for beef, chicken meat is imported because it cannot meet domestic demand [3].

Contribution of agriculture to GDP - From the point of view of the agricultural sector, the physical value of goods or products produced as a result of agricultural activity is expressed as the total amount of money. The share of the agricultural sector in total GDP in 2000 was 16.1% while it decreased by 5.7 percent in 2019 and increased by 7.2 percent in 2021. However, this reduction in rates should not mean a reduction in production in the agricultural sector. This decline is due to the transition to a free market economy, as well as rapid growth in industry, construction, services and other areas. In general, GDP growth in industry, services and other areas in developing countries is higher than agricultural GDP [4,5].

The contribution of agriculture to foreign trade - When we look at the export value of agricultural products, we see that the value is constantly increasing, but the proportion of total exports is declining. This is due to the very high growth rate of total exports over the years. Azerbaijan exports agricultural products to about 50 countries. Russia is the leader of these countries. After Russia, Turkey, Italy, Germany, Ukraine, Iran, Georgia, Belarus, Kazakhstan and Poland are the largest exporters of agricultural products. For this reason, the export of processed agricultural products in Azerbaijan should be encouraged and other necessary steps should be taken in this regard.

As a result of intensive use of arable land and incorrect agricultural machinery in Azerbaijan, its quality and productivity have decreased. This situation has increased the need for chemical fertilizers and pesticides, and as a result, soil and water resources and crop health have been severely compromised. Many fertilizers are imported to Azerbaijan, but the productivity and quality of these fertilizers are very low. Fertilizers must be stored in dry, perfectly warm places. It can then be used. Also, if the fertilizer bag is opened, it should be used completely. But it would be wrong to say that all imported fertilizers are of poor quality. Because a foreign country does not want to lose its market. The problem is that fertilizers are not stored properly. Farmers store fertilizer outdoors, sometimes even in humid places. As a result, fertilizers lose some quality.

One of the problems in the agricultural sector is the unsuitable lands for cultivation. In general, almost half of the 1.6 million hectares of land considered useful for agriculture in Azerbaijan is cultivated to varying degrees. This does not allow to obtain high yields in such places. On the other hand, high-grade crop seeds lose their quality when planted in frosty soil. As modern science develops, new materials development technologies begin to be updated [6-10].

The agricultural sector is becoming more intensive all over the world. As a result of this intensification, intensive, ignorant and unconscious agricultural practices can pose serious threats to human health through animal and plant foods. However, these threats are not limited to human health, but also create serious environmental problems by affecting the trinity of air, water and land. Despite the negative impact of agricultural activities on the environment, there is no alternative to abandoning agricultural production. For this reason, the protection of the environment and natural resources has become the most important issue in agricultural activities.

3.Conclusions

During the Soviet era, the most important economic sector in Azerbaijan after oil and gas was agriculture. Agriculture in Azerbaijan lagged far behind other Soviet countries. Agriculture still retains its position as the country's second largest source of income. With the application of new technologies and methods, this field can be developed rapidly. Because Azerbaijan has all the necessary opportunities to develop agriculture. All that is required is to draw the right strategy, implement it in a disciplined manner and take the necessary measures in advance.

References

1.V.Caferov, The development of the agricultural sector depends on the specialty, Express, p.14, 2015.

2.T.Sadigov, Ways of Livestock Development in Our Country, 2020.
http://www.agro.gov.az/63-lkmizd-heyvandarln-inkiaf-yollar.html

3.A.H.Babayev, V.A.Babayev, Fundamentals of agricultural ecology: Textbook, 302 p., 2011.

4.R.Hussein, Multifunctionality of Agriculture: Its Place and Role in the Global Economic System. Baku: MBM, 2008.
https://bhos.edu.az/kcfinder/upload/files/Tezisler_2020.pdf

5.A.Alirzayev, Problems of socio-economic development of Azerbaijan in the framework of the Strategy of Reforms and Sustainability, Baku, 2005
https://unec.edu.az/application/uploads/2019/09/licanova-hla.pdf

6.S.R.Figarova, E.M.Aliyev, R.G.Abaszade, R.I.Alekberov, V.R.Figarov, Negative Differential Resistance of Graphene Oxide/Sulphur Compound, Journal of Nano Research Submitted, Vol.67, pp. 25-31, 2021.
http://dx.doi.org/10.4028/www.scientific.net/JNanoR.67.25

7.R.G.Abaszade, O.A.Kapush, S.A.Mamedova, A.M.Nabiyev, S.Z.Melikova, S.I.Budzulyak, Gadolinium doping influence on the properties of carbon nanotubes, Physics and Chemistry of Solid State, Vol.21, №3, pp.404-408, 2020.
https://doi.org/10.15330/pcss.21.3.404-408

8.R.G.Abaszade, O.A.Kapush, A.M.Nabiyev, Properties of carbon nanotubes doped with gadolinium, Journal of Optoelectronic and Biomedical Materials, Vol.12, № 3, pp.61–65, 2020.
https://www.chalcogen.ro/61_AbaszadeRG.pdf

9.R.G.Abaszade, Analysis of carbon nanotubes, AJP Fizika, Vol.26, №2, section: Az, pp.25-29, 2020.
http://www.physics.gov.az/physart/256_2020_02_25_az.pdf

10.O.A.Kapush, I.O.Mazarchuk, L.I.Trishchuk, V.Y.Morozovska, S.D.Boruk, S.I.Budzulyak, D.V.Korbutyak, B.N.Kulchitsky, O.G.Kosinov, R.G.Abaszade, Influence of the nature of the dispersion medium on the optical properties of CdTe nanocrystals during sedimentation deposition, Chernivtsi University Scientific Herald, Chemistry (819), pp.7-11, 2019.
https://doi.org/10.31861/chem-2019-819-01

Changes in world energy consumption

M.S.Aliev, T.M.Maharramova, E.A.Melikov

Azerbaijan State Oil and Industry University, Baku, Azerbaijan
tamella.maharramova@asoiu.edu.az, elcin.malikov@asoiu.edu.az

Abstract: It should be noted that such an extensive topic, as energy, cannot be fully and accurately understood only through research conducted in the framework of a science certain area. The fact that the subject of research is important not only for every man on earth, but also for the success of all production kinds, shows how important energy is. While the subject of energy is of interest to many disciplines such as international relations, psychology, history, sociology, law, geology and geography, especially economics, on the other hand, it is difficult to understand depending on the subject. Speaking of all this, it is necessary to better understand the topic of energy and conduct new research in this area.

Keywords: Energy, Countries of the world, Energy production, Modernity, Change.

1.Introduction

World energy consumption is the total energy used by all human civilizations.

This generally requires all of the energy used each year from the energy source we use. Organizations such as the International Energy Agency (IEA), the US Energy Information Administration (EIA), and the European Environment Agency periodically record and publish energy data. Improved World Energy Consumption data can reveal system trends and patterns that could support energy consumption.

2. Experimental details

The annual growth rate of world energy consumption varies from time to time. Between 1920 and 1930, a 20% increase was set at 23% in the 1930s and 1940s, and 29% in the 1940s and 1950s. After 1950, with the increase in the annual growth rate, the growth of consumption, which hit long periods, reached higher rates [1].

For example, between 1950 and 1963, energy consumption increased by 177% over a 13-year period. It is understood that in the post-1960s, world energy consumption was at its second lowest level in the 20th century, but in the following decades (excluding 1990-2000) it was generally at 29%.

These statistics, prepared over decades, show a steady increase in energy consumption. However, a detailed study of the statistics by year shows that in some years there are interruptions or even setbacks in energy consumption.

For example, it is known that such interruptions or delays occurred during short circuits between 1920-21, 1929-32, 1937-38, 1944-45 and 1948-49 [2]. However, these setbacks or stagnation cannot be taken as a sign of adequacy or saturation of energy demand. These setbacks, as in any other field, are due to the negative effects of fluctuations in the world economic and political situation in the energy sector. Wars and economic crises can be cited as the main reasons for such fluctuations [3].

In the above statistics, it is expedient to compare the annual consumption ratios of energy resources (Fig.1). Among these sources, the consumption rate of nuclear energy is the highest. However, the recent introduction of this source prevents its consumption from reaching significant levels.

Among other sources, oil and natural gas are energy sources with very high annual consumption. Although these sources lag behind nuclear energy in terms of annual energy consumption rates, when evaluated in terms of consumption amounts, it is clear that they are consumed in quantities incomparable to the use of nuclear energy.

Oil and natural gas will remain important for some time to come, even if short-term nuclear power and other sources are rapidly consumed. Even if these new reserves show a 100% increase in annual consumption, they will not be able to break the

dominance of oil in the energy sector in the near future and will not be consumed at its level.

A similar situation should be explained for coal. The annual consumption of coal is much lower than the annual consumption of other sources, and coal is in the last place in the ranking when evaluated in this regard.

However, this resource comes immediately after oil with absolute consumption, and according to 2015 data, the annual consumption of coal is 7.7 billion tons. Its significant consumption indicates that coal will retain its importance in the world energy sector for a longer period of time, even if the annual consumption rate is low.

The growing energy needs of the world and the difficulties in finding and using new resources can accelerate the annual consumption of coal, in which case coal can increase its existing importance in the future.

The 63% growth rate of world coal consumption between 2016 and 2020 has led coal-producing countries to re-convert to coal for economic reasons, despite being a fuel that causes some environmental problems.

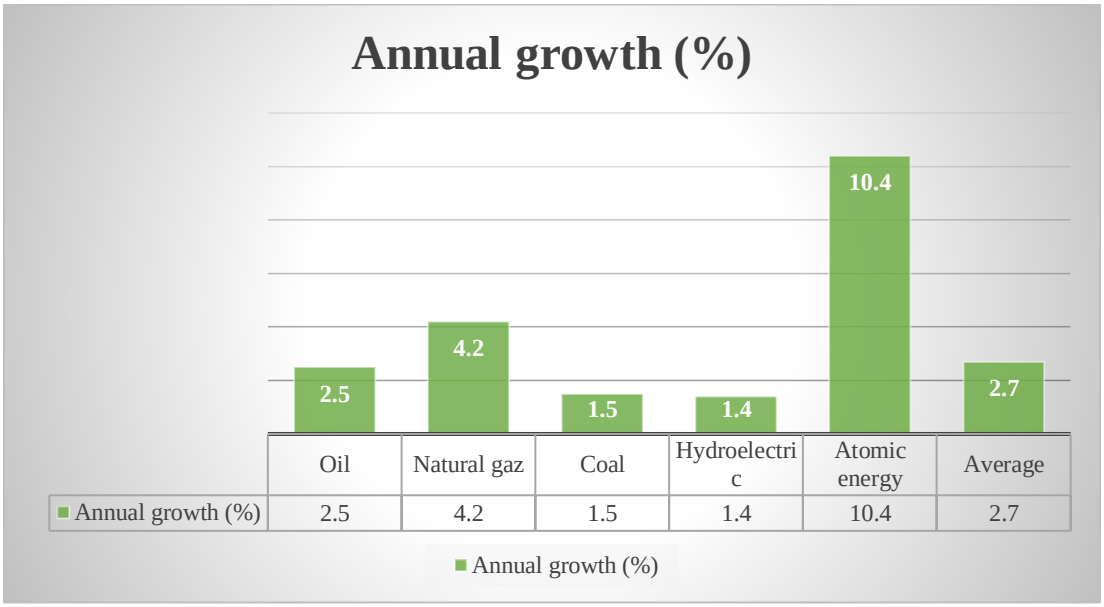

Figure 1. Annual Energy Resources consumption indicators for 1960-1980

Along with the increase in production observed in almost all energy sources, both the development of production methods and innovations in consumer facilities indirectly lead to energy savings, and in this way more efficiency is achieved from a single resource. This situation indirectly increases the rate of energy consumption, even if the amount of resources used is the same.

The efficiency of using animal manure and other plant materials as direct fuel is about 20%. For the same quantities, the efficiency of kerosene is 30%, the efficiency of coal gas is 60%, the efficiency of coal is 40% and the efficiency of electricity is higher than each of them. This is due to the inability to control calories in the use of resources and therefore release some energy.

Both the inability to control the energy released and the change in caloric intake between sources lead to large differences in their consumption and volume. For example, 1 kg.

Heat energy from burning kerosene is obtained from 8.5 kg of wood. Although the caloric difference between wood and kerosene is 1/3, the amount of energy consumed when burning wood can be so large. Each energy source has an area of use that can be more efficient. Today, we do not have a fuel that can replace coal in the metallurgical industry.

Advances in steam turbine technology show that coal can compete with other fuels in terms of energy. Therefore, in countries with sufficient coal reserves, this source will remain important for many years as a source of heat and raw materials.

On the other hand, coal has already been replaced by oil and electricity in air, land, rail and sea transport. Because while the efficiency of locomotives is around 7-8%, the efficiency of diesel locomotives is around 28%.

Similarly, diesel engines are preferred in maritime transport because they use less fuel. In addition, developments in the petrochemical industry are increasing the cost of fuel, and some oil residues, which previously had no economic value, are being brought to economic value.

Some gases and fuel oil from oil refining have significant economic value today, while they used to be waste materials. Electrochemistry and electro-metallurgy are industries that consume large amounts of electricity. Today, electricity is generated from thermal, hydraulic and nuclear power plants. At the same time, efforts are being made to build other facilities that will generate electricity from renewable energy sources.

It should be noted that the explanations made so far have highlighted the dimensions of world energy consumption, the annual growth rate, the resources used, the share of these resources consumption, the increase in efficiency and productivity, and put forward different views. The following explanations will apply to the analysis of energy consumption on a regional scale and will try to present the reasons for inter-regional differences.

The most important conclusion to be drawn from the analysis of energy consumption on a regional scale is the inequality in its distribution. While some regions are noted as areas with very high energy consumption, other regions are found to be far behind in terms of energy consumption.

Another important point in the distribution of consumption is the distribution of regions that consume large amounts of energy and the fact that their boundaries can change over time. This is not due to changes in the factors that make up the distribution of consumption, but due to the fact that consumption is gaining new dimensions.

3. Conclusions

As a result, inequality in energy consumption in the world is due to various factors. The increase in the number of cities, the increase in the population living in cities, the increase in living standards, especially the economic structure, has always tended to increase energy consumption due to various factors.

In addition, the relationship between having an energy source and energy consumption is declining, and consuming more than a certain amount of energy has nothing to do with whether or not there is an energy source. For example, Japan's national resources are too small to meet its energy needs, but it can meet its energy needs from external sources. For this reason, resource availability is not considered a factor that directly affects resource use.

Depending on the degree of these factors influence, energy consumption may increase in some parts of the world and remain negligible in others. Thus, these factors have led to an unequal distribution of consumption on a global scale.

At first glance, it is noteworthy that the areas with high energy consumption are both industrial centers and socio-economically developed. In areas dominated by the rural economy, energy consumption remains at or slightly above the level of individual needs.

In addition, the energy consumed is mainly provided by non-commercial energy sources.

Thus, economic factors are influential in the distribution of energy consumption, and energy consumption and distribution on earth vary by economic region. The first is the region where economically developed countries are located, and the second is the region of countries that can be considered developing or underdeveloped countries.

These regions, which have variable borders, are separated by significant differences in energy consumption, as in many other areas. The energy consumed in these regions differs greatly in terms of both absolute quantity and per capita consumption.

References

1.I.Akova, Renewable Energy Resources, Nobel Publications, Ankara, 390 p., 2008.
http://dx.doi.org/10.4000/echogeo.12457

2.I.Akova, Changes in Energy Use, Ankara, 453, 2016.

3.Jackson et al.: Persistent fossil fuel growth threatens the Paris Agreement and planetary-health, Environmental Research Letters (14), 400 p., 2019.
https://doi.org/10.1088/1748-9326/ab57b3

Aerospace research methods around the world

Sh.M.Shafiyeva

Azerbaijan Architecture and Construction University, Baku, Azerbaijan
shafishalala@gmail.com

Abstract: Aerospace is a term used to collectively consult with the atmosphere and outer area. Aerospace activity may be very diverse, with a large number of commercial, industrial and military applications. Aerospace engineering includes aeronautics and astronautics. Aerospace corporations studies, design, manufacture, operate, or hold plane and spacecraft.

Keywords: Aerodynamics, Aerospace engineering, Aircraft, astronautic, Newspace, Space agencies, Space exploration, Spacecraft.

1.Introduction

During the past years of the space age, interplanetary satellites have been automatically transferred from Earth's satellites, wheeled spacecraft have been replaced by giant orbital stations, and everything from simple experiments in space to fundamental scientific and economic research has been carried out. Space research has revealed a deep connection between the processes taking place between the Sun and the Earth's orbit. This, in turn, has allowed people to understand a number of life events related to solar activity. With the help of rocket and space technology, the most delicate stages of the earth's history have already been studied, and the processes taking place in its deep layers have been studied [1-3]. Comparative planetary science has become an important part of Earth science. The structure and evolution of our planet have been studied in the example of other celestial bodies. At the same time, cosmonautics, with its vast scientific potential, already provides concrete and significant benefits to human economic activity. Communications, meteorology, agriculture and forestry, sea and air transport, energy, etc. Other areas such as space cannot be imagined without space exploration. Shooting methods and techniques are constantly updated and improved. Depending on the nature of the issues to be addressed and the requirements, the ability to receive, transmit and process information is constantly updated. Unlike photography systems, scanners and radar systems are now more widely used because they have greater advantages. Scanning systems are widely used in different types of satellites to solve various problems. based on the study of the environment and natural resources NOAA (National Oceanic and Atmospheric Administration), GOES (Geostationary Operational Satellites), ERS (European Remote Sensing Satellite), IRS (Indian Remote Sensing), SPOT (Satellite Pour Lobservation de la Terre) satellite systems and others can be implemented. Global data acquisition is the ability to obtain information from a large area of the Earth's surface in a short period of time. Globalization with the help of spacecraft is due to the fact that the satellite is located at a considerable distance from the Earth's surface, ie at a distance of 200 km to 36,000 km. Even low-orbit (flying) satellites (devices in satellites) cover an area of thousands of square kilometers at the same time. As the height of the orbit increases, this area increases, and for a geostationary satellite with an altitude of 36,000 km, this field of view is about half of the Earth's surface [1-8].

2. Experimental details

For the important aerospace countries, their very own navy institutions and, in some cases, foreign militaries constitute the largest clients. the next most crucial customers are the arena’s commercial airlines, typically American, eu, and Asian–Pacific Rim carriers. The 3 largest markets for plane are North the usa, which is ruled by way of the united states; the Asia-Pacific place, which is ruled by using China, and Europe. The US possesses the sector’s biggest

aerospace business complicated. As of 2017, American corporations constituted simply beneath half of of the global aerospace enterprise.even though their personal authorities is the principal procurer of army systems, American corporations are also the dominant dealer of each navy and civil aerospace hardware to the rest of the sector. today, non-American businesses are seeking a bigger portion of the worldwide market and assignment American dominance. One of the main problems facing modern science is the technology of preparation of new materials [9-14].

Russia keeps a massive aerospace enterprise. After the breakup of the Soviet Union in 1991, Russia acquired maximum of the highly equipped Soviet layout bureaus. Partnerships with American and european firms had been initiated, and Russia entered Western markets for the first time. Western Europe's aerospace industry has grow to be a sturdy international player, with France, the UK, and Germany especially lively. thru the fulfillment of cooperative packages consisting of the Airbus line of commercial transports and the Ariane circle of relatives of space release automobiles, the european industry has won full-size revel in in the improvement and manufacture of just about the whole range of aerospace systems. In the Asia–Pacific Rim place, China has the main aerospace industry, however—in comparison with the united states and western Europe—its talents are nonetheless restricted. China has made development of an indigenous aviation enterprise a national priority and has partnerships with some of foreign ventures in both plane and spacecraft structures. The U.S.A .additionally has advanced area launchers, small satellites, and craft supposed for crewed spaceflight. Japan has a thriving aerospace industry with an emphasis on army plane, and jap businesses additionally carry out as key subcontractors to firms inside the america and Europe. The pursuits of the U.S. aerospace enterprise are represented thru the Aerospace Industries affiliation of america (AIA), an aerospace-industry-funded company whose club consists of the important groups in the area. The AIA affords a discussion board for technical and coverage problems concerning the industry and serves as a lobbying agent for the not unusual hobbies of its members. Its parallel in Europe is the Aerospace and Defence Industries association of Europe (ASD). based totally in Brussels, ASD interfaces with member nations in addition to the european Union. similarly, Europe has several corporations on the country wide degree. other incredible associations are the Society of eastern Aerospace groups (SJAC) and the Aerospace Industries affiliation of Canada (AIAC). The global decline in the acquisition of air defense facilities after the end of a bloodless war during the early 19th Century has brought many manufacturers in the United States, Europe, and Russia closer to a balanced mix of military and civilian products. A few firms have developed space military hardware for public use or to search for non-space markets for information. in order to remain profitable, many companies have developed an almost endless process of integration, integration, division, and joint ventures around the world and partnerships. although, all were affected to some extent by the following factors: the ever-increasing cost of producing a new sophisticated aircraft and spacecraft, global trade in the financial system, the unstable rate of presidential spending on defense systems, national airline and ambitions, and local sales and pricing. low entry level. these are the factors that determine the size and scope of the aerospace industry today.

3. Conclusions

Cosmonautics, with its vast potential, now provides concrete and tangible benefits to human economic activity. Communications, meteorology, agriculture and forestry, maritime and air transport, energy, geology, etc. Other areas such as cannot be imagined without space exploration. These and other problems such as meeting the energy needs of industrial facilities, combating environmental pollution, overcoming the shortage of natural resources, providing the population with food, increasing the reliability of weather and climate forecasting, reducing the production of electronics and medical supplies. is one of the most pressing issues for mankind. The effectiveness and solution of many of these issues is not possible without the use of the latest advances in space exploration. For example, it should be noted that the solution of the problems of agricultural production requires the intensive application of MZ methods in geological practice, the study and use of biological resources of the world's

oceans. Achieving significant progress in the field of long-term weather forecasting requires an in-depth and comprehensive study of the processes taking place in the Earth's atmosphere, its interaction with the ocean and the Earth's space. Understanding the mechanism of climate change, the laws of distribution of mineral resources, tectonic activity on Earth is associated with the study of other objects in the solar system and their satellites, which allows to answer some questions about the ancient history of the Earth only in outer space. The application of space technology and technology in the study of natural resources allows to solve many problems in this area in new ways - globally, by providing regular observations and obtaining results quickly.

References

1.A.Sh.Mehdiyev., B.M.Azizov, C.S.Mehdiyev, Aerocosmical monitoring. Baku, (In Azeri)
2.A.Sh.Mehdiyev., B.M.Azizov, C.S. Mehdiyev, Physical bases remote sensing, Baku, 2014 (In Azeri)
3.B.M.Azizov, A.A.Abbaszada, Basics of aero-space research. Baku, 2004 (In Azeri)
4.A.I.BAklanov, Surveillance and monitoring systems, Moscow, 2009
5.V.T.Fisenko, and et. all Computer processing and recognition of images, Moscow, 2008
6.G.Ferrier, Evaluation of apparent surface reflectance estimation methodologies, Inter Journal of remote Sensing, Vol.16, pp.2291-2297, 1995.
7.B.C.Gao, K.B.Heidebmcht, A.F.H.Goetz, Dervation of Scaled Reflecta AVIRIS Data, Remote Sensing of Environment, Vol.44, pp.165-178, 1993.
8.M.W.Matthew, S.M.Adler-Golden, A.Berk, S.C.Richtsmeier, R.Y.Levine, L.S.Bernstein, G.P.Anderson, Status of Asmospheric Correction Using a MODTRAN4- based Algorithm, SPIE Procceding Algorithms for Multispectral, Hyperspectral, and Ultra-spectral imagery VI, 4049, pp.199-207, 2000.
http://dx.doi.org/10.1117/12.410341
9.S.R.Figarova, E.M.Aliyev, R.G.Abaszade, R.I.Alekberov, V.R.Figarov, Negative Differential Resistance of Graphene Oxide/Sulphur Compound, Journal of Nano Research Submitted, Vol.67, pp. 25-31, 2021.
http://dx.doi.org/10.4028/www.scientific.net/JNanoR.67.25
10.R.G.Abaszade, O.A.Kapush, S.A.Mamedova, A.M.Nabiyev, S.Z.Melikova, S.I.Budzulyak, Gadolinium doping influence on the properties of carbon nanotubes, Physics and Chemistry of Solid State, Vol.21, №3, pp.404-408, 2020.
https://doi.org/10.15330/pcss.21.3.404-408
11.R.G.Abaszade, O.A.Kapush, A.M.Nabiyev, Properties of carbon nanotubes doped with gadolinium, Journal of Optoelectronic and Biomedical Materials, Vol.12, № 3, pp.61–65, 2020.
https://www.chalcogen.ro/61_AbaszadeRG.pdf
12.R.G.Abaszade, Analysis of carbon nanotubes, AJP Fizika, Vol.26, №2, section: Az, pp.25-29, 2020.
http://www.physics.gov.az/physart/256_2020_02_25_az.pdf
13.O.A.Kapush, I.O.Mazarchuk, L.I.Trishchuk, V.Y.Morozovska, S.D.Boruk, S.I.Budzulyak, D.V.Korbutyak, B.N.Kulchitsky, O.G.Kosinov, R.G.Abaszade, Influence of the nature of the dispersion medium on the optical properties of CdTe nanocrystals during sedimentation deposition, Chernivtsi University Scientific Herald, Chemistry (819), pp.7-11, 2019.
https://doi.org/10.31861/chem-2019-819-01
14.R.G.Abaszade, S.A.Mamedova, F.H.Agayev, S.I.Budzulyak, O.A.Kapush, M.A.Mamedova, A.M.Nabiyev, V.O.Kotsyubynsky, Synthesis and Characterization of Graphene Oxide Flakes for Transparent Thin Films, Physics and Chemistry of Solid State, Vol.22, №.3, pp.595-601, 2021.
DOI: 10.15330/pcss.22.3.595-601

Research of heavy metals in the atmospheric air of Goygol district as a biointicator

Sh.S.Nuhuyeva

Azerbaijan State Agrarian University, Ganja, Azerbaijan
nuhuyeva83@mail.ru

Abstract: The industrial and agricultural sectors have a significant anthropogenic impact on the environment. Moss biomonitoring technique is the first attempt to study the precipitation of heavy metals in Azerbaijan, a country with different relief and climate, using NAA. The study determined the precipitation of heavy metal pollutants in the Goygol, Dashkasan and Gadabay districts. Moss samples (mainly Hylocomium splendens, Pleuroziumschreberi) were collected from the studied areas. Concentrations of 44 elements were determined (Na, Mg, Al, Si, Cl, K, Ca, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Br, Rb, Sr, Mo, Ag, Cd, In, Sb, I, Cs, Ba, La, Ce, Nd, Sm, Eu, Tb, Tm, Yb, Hf, Ta, W, Au, Th, U). Multidisciplinary statistical analysis of the obtained analytical results will allow to identify the main sources of pollution and assess the role of long-distance transport of pollutants..

Keywords: Biomonitor, Neutron activation, Heavy metal.

1.Introduction

Atmospheric air quality control is considered one of the most important aspects in ensuring human health and sustainable development. Particular attention is paid to the contamination of heavy metals with substances entering the atmosphere as a result of human activities. The presence of heavy metals in a number of geochemical and biochemical irreversible processes leads to ecological imbalances that cause serious diseases. Atmospheric pollution with heavy metals has increased significantly over the last 20-30 years. Thus, heavy metals are transported by air masses over long distances from sources and have the property of spreading and settling in the environment, so their complications do not occur immediately, but over a period of time. For this reason, regular monitoring of heavy metals, radionuclides and other toxic elements in the atmosphere is important in the assessment and long-term forecasting of environmental pollution.

The areas selected in the study (Goygol, Dashkasan, Gadabay districts) have long been subject to intensive pollution by industry and various economic complexes. Especially in recent years, the elemental pollutants in these areas have not been fully investigated. At the same time, systematized information on environmental pollutants and sources of these pollutants, forecasting levels of concentrations of heavy metals and other pollutants, as well as effective methods to reduce them have not been developed.

Moss technique is widely used in many European countries to monitor the precipitation of heavy metals in the atmosphere. The state of the environment and thus the health of the population depends largely on the state of the earth's atmosphere. The atmosphere is a mixture of natural gases [1]. In addition, there may be airborne pollutants, as well as suspensions of liquid or solid particles. Particles enter the air either from natural sources (soil, rocks, water bodies and living organisms) or as a result of anthropogenic activities (industrial, transport, fuel, human waste, etc.).

In practice, air pollution monitoring is a multifaceted problem. It is necessary to identify the sources of various pollutants and their emissions, to select appropriate analytical methods to quantify the concentrations of certain elements with the required accuracy, to assess the degree of risk associated with the impact of individual pollutants on the environment and human health [2-4]. The study of the deposition of trace elements in the atmosphere using special aerosol filters is a classic line of research in this field. Sampling for aspiration requires special equipment [5]. The method is difficult and not productive for exploring large areas. Since the early 1990s, intensive research has been conducted in

individual countries and internationally to develop new, modern methods for assessing air pollution. One of these directions is the study of the precipitation of heavy metals and other toxic elements in the atmosphere with the participation of biomonitors [6-10]. Biomonitors are living organisms that serve to quantify the state of the environment. Biomonitors include lichens, mosses, ferns, grasses, bark and leaves of trees, needles of conifers, etc. It is used. Moss technique was first used in the Scandinavian countries [11-15]. Moss biomonitoring has been developed since 1960 as a method of studying the precipitation of heavy metals in the atmosphere [16-18]. Mosses do not have a developed root system. Therefore, they easily adsorb elements from the atmosphere. The advantage of the method is the simplicity of collecting samples. Purification of polluted air is also possible on the basis of new materials [21,22,27-29].

Two types of Pleuroziumschreberi and Hylocomium splendens mosses were taken to study the deposition of basic and microelements in the atmosphere in Azerbaijan. Samples were taken according to a special methodology. The coordinates of the sampling areas were determined using GPS [19,20]. The sampling map is shown in Figure 1.

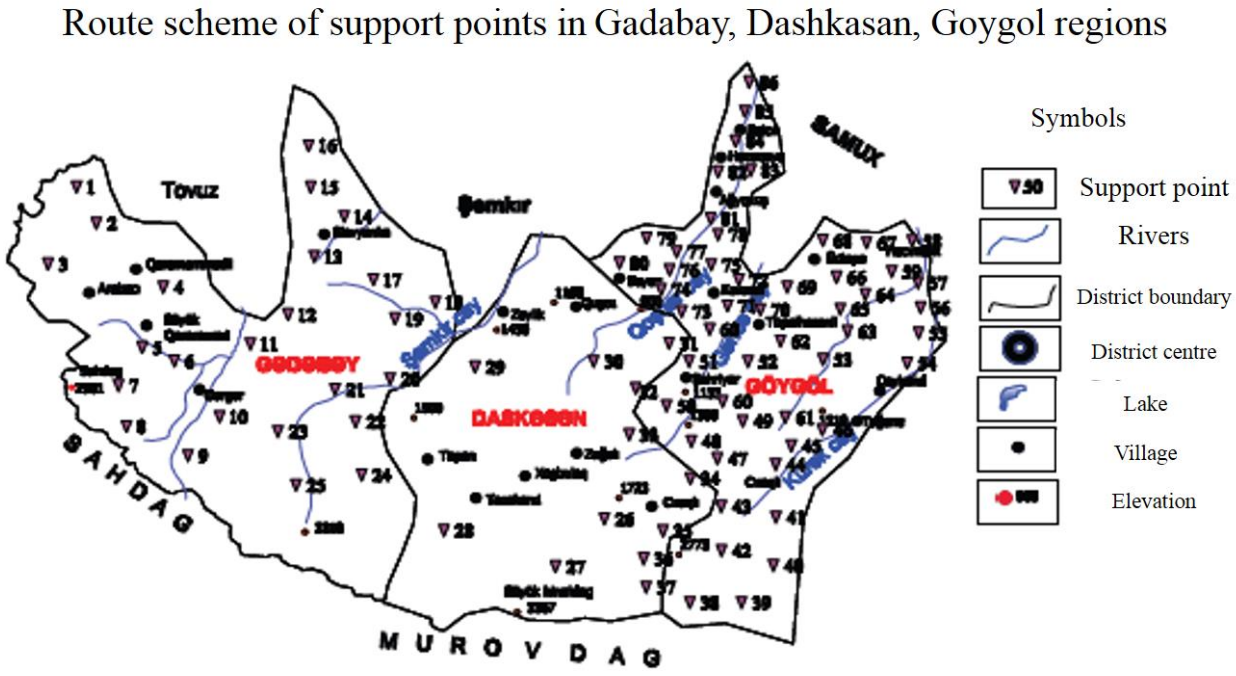

Figure 1. Sampling map

Each sample was cleaned of soil particles, dry leaves, needles, sticks, and so on. Polyethylene gloves were used throughout the processing of the samples to prevent contamination of the material. Only green and green-brown shoots of the last three years were taken for analysis. After cleaning, about 0.3 g of moss is brought in press forms. The samples are then drawn accurately. Mosaic samples for short-term irradiation were packed in heat-sealed polyethylene foil bags, and samples for long-term irradiation were packed in aluminum containers.

Neutron activation analysis of moss samples was performed at the Frank Neutron Physics Laboratory (FLNP, JINR, Dubna) in an IBR-2 pulsed high-speed reactor [21,22].

2. Experimental detail

Na, Mg, Al, Si, Cl, K, Ca, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Br, Rb, Sr, Mo, Ag, Cd, Concentrations of the elements In, Sb, I, Cs, Ba, La, Ce, Nd, Sm, Eu, Tb, Tm, Yb, Hf, Ta, W, Au, Th, U were determined. The results obtained for the studied elements were compared with the results obtained from Northern Norway and the Republic of Georgia. A comparison of Azerbaijani-Norwegian moss

concentrations showed increasing values for most heavy metals (Mg, Al, V, Fe, As, Mo, Cd, La and U) in the samples studied, depending on the industrial situation. It can be assumed that the main potential sources of air pollution from the industrial sector of these areas are gold, including silver and copper, iron ore, aluminum, cobalt and marble, non-ferrous industrial plants.

Multivariate statistical analysis (FA) was used to identify, characterize, and identify the most contaminated sources [23].

Particularly high in factor 1 are Cs (0.93), Sc (0.90), Hf (0.86), Al (0.82), Fe (0.80), Na (0.79), Ba (0.72), Co (0.70), Mn (0.69), Ti (0.66) and rare earth elements Tb (0.94), Yb (0.91), Tm (0.90), Sm (0.80), Ce (0.75), Nd (0.73), La (0.61). Most of these elements are characteristic of the earth's crust material, and it is likely that this component at least partially reflects the contamination of moss samples with soil particles. Another possible source could be volatile ash particles formed as a result of high temperature processes, such as the combustion of coal, which has a basic element composition similar to that of the earth's crust material.

Factor 2 has high values of As (0.73), Ni (0.63), Cr (0.62), Mg (0.62), Th (0.61) and U (0.72). As - high concentrations of toxic and carcinogenic elements are mainly associated with the combustion of copper and gold ores, as well as coal. Ni and Cr - these elements in the current samples are in the same order as those found in neighboring Georgia. For U and Th components of the crust - the highest prices were observed at four sampling sites located near the gold (as well as silver and copper) production plant. The main sources of high pollution in the region are the extraction of iron ore, aluminum, cobalt and marble. It also produces gold, copper, cobalt, iron ore and marble.

Factor 3 has high levels of Cu (0.63), Rb (0.55), Cd (0.59) and Au (0.69). These elements may be related to the emissions of the metallurgical industry in Ganja.

Factor 4 has high values for Cl (0.89), K (0.86) and Zn (0.64) associated with the green areas of the sample zone. The high cost of zinc is observed in two sampling areas: the company, located near 24 and 10, is engaged in the production of metal structures and equipment for the construction industry. A possible source of the factor may be scrap metal. A simple statistical analysis of the data was performed to investigate possible correlations between the different variable values. The correlation matrix shows that most metals have good correlation. The most significant positive correlation is between Al and V (r = 0.96); Al and Ti (r = 0.97); Ti and V (r = 0.94); Fe and Co (r = 0.96); Cr and Fe (r = 0.90); Cr and Co (r = 0.90); Sc and Fe (r = 0.99); Sc and Co (r = 0.97); Sc and V (r = 0.91); Mg and Al (r = 0.89); Mg and Ti (r = 0.87); Al and Sc (r = 0.89); Al and Cs (r = 0.91). There is also a significant correlation between Na and Al (r = 0.88); Na and most transition metals (Sc, Ti, V, Cr, Fe, Co, Hf and Ta r = 0.91; 0.90; 0.85; 0.85; 0.90; 0.93; and 0, 89 respectively); there is also a correlation between Na and rare earth elements (La, Ce, Sm, Tb and Tm r = 0.85; 0.84; 0.86; 0.87 and 0.80, respectively). In general, the correlation matrix shows that rare earth elements are well correlated with Mg and Al, as well as with transit metals. Th and U (r = 0.96), Ta and U (r = 0.96), V and Th (r = 0.92), U and Hf (r = 0.93), as well as Hf and Th (r = 0.96) there is a significant correlation between.

3. Conclusions

Preliminary studies show that moss biomonitoring of heavy metals in the atmosphere is an effective method for studying the environmental situation in the mountainous areas of Azerbaijan, which is characterized by mining and industry. The experience of this research can be successfully used in other regions of the country.

References

1.G.Baumbash, Air Quality Control. U Forstner, R.J. Murphy, and W. H. Rulkens (Eds), Series: Environmental Engineering, Springer, Heidelberg, Herlin, 490p.,1996.

2.T.Berg, E.Steinnes, Use of mosses (Hylo-comium-splendens and Pleuroziumschreberi) as biomonitors of heavy metal deposition: from relative to absolute deposition values. International Journal of Environmental pollution 98, 61-71, 1997. https://pubmed.ncbi.nlm.nih.gov/15093345/

1. A.Buse, D.Norris, H.Harmens, P.Buker, T.Ashenden, Mills G. (Eds), European Atlas: Heavy Metals in European mosses: 2000/2001 survey,

UNECE ICP Vegetation. Centre for Ecology and Hydrology, pp.1-50,2003.
http://nora.nerc.ac.uk/id/eprint/3928/1/Final_moss_report_with_maps_(110708)_proof_edits_(180708).pdf
3.M.V.Frontasyeva, Neutron activation analysis for the Life Sciences. A review. Physics of Particles and Nuclei 42 (2), 332-378,2011.
https://www.researchgate.net/publication/234064477_Neutron_Activation_Analysis_in_the_Life_Sciences
4.L.De Temmerman, J.N.B.Bell, J.P.Garrec, A.Klumpp, G.H.M.Krause, A.E.G.Tonneijck, Biomonitoring of air pollutants with plants − considerations for the future. In: A. Klumpp, W. Ansel, G. Klumpp (Eds), Urban Air Pollution, Bioindication and Environmental Awareness,CuvillierVerlag, Göttingen, pp. 337-373, 2004.
https://research.wur.nl/en/publications/biomonitoring-of-air-pollutants-with-plants-considerations-for-th
5.A.Y.Dmitriev, S.S.Pavlov, Automation of quantitative determination of elemental content of samples by neutron activation analysis at the reactor IBR-2 in FLNP JINR. Physics Of Particles And Nuclei Letters 10, No1(178), pp.58-64, 2013.
https://inis.iaea.org/search/search.aspx?orig_q=RN:52056857
6.M.V.Frontasyeva, S.S.Pavlov, Analytical investigations at the IBR-2 reactor in Dubna. JINR Preprint E14-2000-177, Dubna, 2000
https://inis.iaea.org/search/search.aspx?orig_q=RN:31062605
7.H.Gydesen, K.Pilegaard, L.Rasmussen, A.Riihling, Moss analyses used as a means of surveying the atmospheric heavy metal deposition in Sweden, Denmark and Greenland in 1980, Report svn pm 1670, National Swedish Environment Protection Board, Solna, 1983.
http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.463.3166&rep=rep1&type=pdf
8.H.Harmens, D.A.Norris, E.Steinnes, E.Kubin, J.Piispanen, R.Alber, Y.Aleksiayenak, O.Blum, M.Coşkun, M.Dam, L.De Temmerman, J.A.Fernández, M.Frolova, M.Frontasyeva, L.González-Miqueo, K.Grodzińska, Z.Jeran, S.Korzekwa, M.Krmar, K.Kvietkus, S.Leblond, S.Liiv, S.H.Magnússon, B.Maňkovská, R.Pesch, Å.Rühling, J.M.Santamaria, W.Schröder, Z.Spiric, I.Suchara, L.Thöni, V.Urumov, L.Yurukova, H.G.Zechmeister, Mosses as biomonitors of atmospheric heavy metal deposition: spatial and temporal trends in Europe. Environmental Pollution 158, 3144-3156, 2010.
http://icpvegetation.ceh.ac.uk
9.B.Markert, O.Wappelhorst, V.Weckert, U.Herpin, U.Siewers, K.Friese, G.Breulmann, The use of bioindicators for monitoring the heavy-metal status of the environment. Journal of Radioanalytical and Nuclear Chemistry 240(2), 425-429, 1999.
https://www.academia.edu/16817571/The_use_of_bioindicators_for_monitoring_the_heavy_metal_status_of_the_environment
10.B.Markert, K.Friese, Trace elements: Their distribution and effects in the environment, Elsevier Science, Amsterdam,2000.
https://www.elsevier.com/books/trace-elements/markert/978-0-444-50532-3
11.B.Markert, A.Breure, H.G.Zechmeister (Eds), Bioindicators and biomonitors, principles, concepts and Applications, Elsevier, Amsterdam, Tokyo, New York, 2003.
https://www.elsevier.com/books/bioindicators-and-biomonitors/markert/978-0-08-044177-1
12.B.Markert et al., Chemical evolution. in: E.Merian M.Anke, M.Ihnat, M.Stoeppler (Eds), Elements and their compounds in the environment, pp. 235-254, Wiley VCH, Weinheim, Tokyo, New York, 2004.
https://link.springer.com/content/pdf/bbm%3A978-3-319-14355-2%2F1.pdf
13.L.Barandovski, V.M.Frontasyeva, T.Stafilov, R.Šajn, M.T.Ostrovnaya (2015) Multielement atmospheric deposition in Macedonia studied by the moss biomonitoring technique. Environ SciPollut Res 22:16077–16097
https://www.mdpi.com/2073-4433/11/12/1379/pdf
14.B.Markert, S.Wuenschmann, S.Fraenzle, O.Wappelhorst, V.Weckert, G.Breulmann, R. Djingova, U. Herpin, H.Lieth, W.Schroder, U.Siewers, E.Steinnes, B.Wolterbeek, H.Zechmeister, On the road from environmental biomonitoring to human health aspects: Monitoring atmospheric heavy metal deposition by epiphytic/epigeic plants: present status and future needs. International Journal of Environment, p.498, 2008.
https://www.researchgate.net/publication/325170469_On_the_road_from_environmental_biomonitoring_to_human_ealth_aspects_Monitoring_atmospheric_heavy_metal_deposition_by_epiphyticepigeic_plants_Present_status_and_future_needs
15.H.B.Ross, On the use of mosses (Hylocomiumsplendens and Pleuroziumschreberi) for estimating atmospheric trace metal deposition, Water, Air Soil Pollution 50, 63-76,1990.

https://www.sciencedirect.com/science/article/abs/pii/S0269749197001036
16.R.Gerdol, R.Marchesini, P.Iacumin, L.Brancaleoni, Monitoring temporal trends of air pollution in an urban area using mosses and lichens as biomonitors, Chemosphere, 108:388-95, 2014. https://pubmed.ncbi.nlm.nih.gov/24630254/
17.CLRTAP (2015) Manual on methodologies and criteria for modelling and mapping critical loads and levels and air pollution effects, risks and trends. UNECE Convention on Long-range Transboundary Air Pollution. http://icpvegetation.ceh.ac.uk.
18.L.Barandovski, M.Cekova, M.V.Frontasyeva, S.S.Pavlov, T.Stafilov, E.Steinnes, V.Urumov, Air pollution studies in macedonia using the moss biomonitoring technique, NAA, AAS and GIS technology, 21 p., 2006. http://www1.jinr.ru/Preprints/2006/160(E18-2006-160).pdf
19.E.Steinnes, L.B.Jacobsen, The use of mosses as monitors of trace element deposition from the atmosphere in Arctic regions: a feasibility study from Svalbard. Norsk Polar Institute Report Series no 88, Oslo, Norway,1994.
20.R.Wittig, General aspects of biomonitoring heavy metals by plants. In: Markert, B. (Eds) Plants as bio-monitors indicators for heavy metals in the terrestrial environment, VCH, Weinheim. pp.3-28, 1993.
21.S.R.Figarova, E.M.Aliyev, R.G.Abaszade, R.I.Alekberov, V.R.Figarov, Negative Differential Resistance of Graphene Oxide/Sulphur Compound, Journal of Nano Research Submitted, Vol.67, pp. 25-31, 2021. http://dx.doi.org/10.4028/www.scientific.net/JNanoR.67.25
22.R.G.Abaszade, O.A.Kapush, S.A.Mamedova, A.M.Nabiyev, S.Z.Melikova, S.I.Budzulyak, Gadolinium doping influence on the properties of carbon nanotubes, Physics and Chemistry of Solid State, Vol.21, №3, pp.404-408, 2020.
23.R.G.Abaszade, O.A.Kapush, A.M.Nabiyev, Properties of carbon nanotubes doped with gadolinium, Journal of Optoelectronic and Biomedical Materials, Vol.12, № 3, pp.61–65, 2020. https://doi.org/10.15330/pcss.21.3.404-408
https://www.researchgate.net/publication/221929618_Biomonitoring_of_Airborne_Heavy_Metal_Contamination
24.S.Shetekauri, T.Shetekauri, A.Kvlividze, O.Chaligava, T.Kalabegishvili, E.I.Kirkesali, M.V.Frontasyeva, O.E.Chepurchenko, Preliminary results of atmospheric deposition of major and trace elements in the Greater and Lesser Caucasus mountains studied by the moss technique and neutron activation analysis. Annali di Botanica, 5, pp. 89-95, 2015.
25.S.Shetekauri, O.Chaligava, T.Shetekauri, A.Kvlividze, T.Kalabegishvili, E..I.Kirkesali, M.V.Frontasyeva, O.E.Chepurchenko, V.A.Tselmovich, Biomonitoring Air Pollution Using Moss in Georgia. Polish Journal of Environmental Studies, vol.27, No5, pp. 2259-2266, 2018. http://www.pjoes.com/Biomonitoring-Air-Pollution-Using-Moss-nin-Georgia,73798,0,2.html
26.N.Slonina, P.Swislowski, M.Rajfur, Passive and active atmospheric aerosol with the use of mosses, 28(2):163-172,2021. https://sciendo.com/it/article/10.2478/eces-2021-0012
27.M.Y.Nurulshyha, A.A.NurIzzatul, Moss as Bio-indicator for Air Quality Monitoring at Different Air Quality Environment. International Journal of Engineering and Advanced Technology (IJEAT) ISSN: vol.10, pp.2249-8958, 2021. https://www.ijeat.org/wp-content/uploads/papers/v10i5/E25790610521.pdf https://www.chalcogen.ro/61_AbaszadeRG.pdf
28.R.G.Abaszade, Analysis of carbon nanotubes, AJP Fizika, Vol.26, №2, section: Az, pp.25-29, 2020. http://www.physics.gov.az/physart/256_2020_02_25_az.pdf
29.O.A.Kapush, I.O.Mazarchuk, L.I.Trishchuk, V.Y.Morozovska, S.D.Boruk, S.I.Budzulyak, D.V.Korbutyak, B.N.Kulchitsky, O.G.Kosinov, R.G.Abaszade, Influence of the nature of the dispersion medium on the optical properties of CdTe nanocrystals during sedimentation deposition, Chernivtsi University Scientific Herald, Chemistry (819), pp.7-11, 2019. https://doi.org/10.31861/chem-2019-819-01

Environmental impact of plastic waste

M.R.Hajiyeva, L.H.Mammadova

Azerbaijan University of Architecture and Construction, Baku, Azerbaijan
hajiyevamariya0@gmail.com, l.mamedova.ekologiya@gmail.com

Abstract: The article discusses the impact of plastic waste on the environment and the problems they create. In general, work should be done to reduce them. Plastic waste has become a global problem in the world and in our country. It causes many such diseases in the human body. Projects should be developed and implemented to minimize plastic waste.

Keywords: Plastic waste, Losses of plastic substances, Processing of PET bottles, "Green" technologies.

1.Introduction

Plastic containers generate an additional 120 million tons of waste each year. The products are based on bisphenol-A, which is dangerous to human health. Bisphenol A is an organic compound belonging to the phenol group.

As we know, a large amount of dioxin is released during the incineration and melting of plastic waste. According to the International Institute for Cancer Research, dioxin causes cancer. It is impossible for the substance to enter the body and be excreted in the adipose tissue. There are no drugs to reduce its effects. Scientists also do not recommend storing and heating food in plastic containers. Polyethylene bags with an average shelf life of 20 minutes account for about 10 percent of total waste. According to statistics, a family uses about 500 polyethylene bags a year. It takes more than 500 years for those packages to rot. Due to the large number of bacteria on the polyethylene, the food in the bags spoils more quickly. Condensate forms in a tightly closed transparent package and various fungi grow. When polyethylene products are frozen, they release toxins that are harmful to humans. Every year, 4 trillion bags are used in the world, and 1 million plastic bags are thrown in the trash every minute. They remain in the environment for a long time and do not rot.

2. Experimental details

At present, in many developed countries, the relevant legal framework is being created to reduce the use of plastic packaging, and the system of their collection and recycling is being improved. Many European countries use methods such as paying for plastic bags or imposing an environmental tax on them as a basic measure. In addition, the use of reusable cloth bags, bags that can be broken down by bacteria or other living organisms is also among the measures taken. A number of measures have been taken in recent years to reduce plastic waste in the region. At the initial stage, Turkey has banned the distribution of plastic bags with a thickness of 15-50 microns to users or consumers free of charge at all points of sale. Georgia has banned the import, production and sale of plastic bags with a thickness of less than 15 microns, and manufacturers have been required to mark the company's logo and name on their bags.

Sustainable and efficient management of resources is an indispensable necessity today. Compared to 1900 today,

- Three times the energy consumption per capita,
- Use of raw materials twice,
- The world's population has increased 5 times.

In the technology that emerged as a result of the industrial revolution, more and more waste may be generated than in the past, as innovations increase the population and urbanization, differentiate living standards and consumption habits. This situation also causes air, water and soil pollution to such an extent that it threatens all living things, including issues such as depletion of natural resources and climate change.

Within the framework of the principles of sustainable development, the zero waste principle must be targeted and waste management must be ensured in order to control waste and leave a clean, developed

and livable world. The Zero Waste Project is based on a 7-step roadmap for a sustainable, professional approach.

Disadvantages of plastic waste: - According to statistics, every year the world produces 500 million tons of plastic products. It takes 800 years on land and 400 years at sea for plastic and polyethylene products to disintegrate. Even after half a century, the plastic solution continues to contaminate the soil. Plastic containers generate an additional 120 million tons of waste each year. Thus, only 20% of plastic waste in the world is recycled. Plastic accounts for 90 percent of the world's waste. Every year, 150 tons of plastic waste is dumped into the oceans. Large waste islands have formed in the oceans. There are currently 5 such islands. Two of them are in the Pacific, two in the Atlantic and one in the Indian Ocean. Plastic waste kills wild animals, birds and fish. Every year, millions of sea creatures die due to plastic waste.

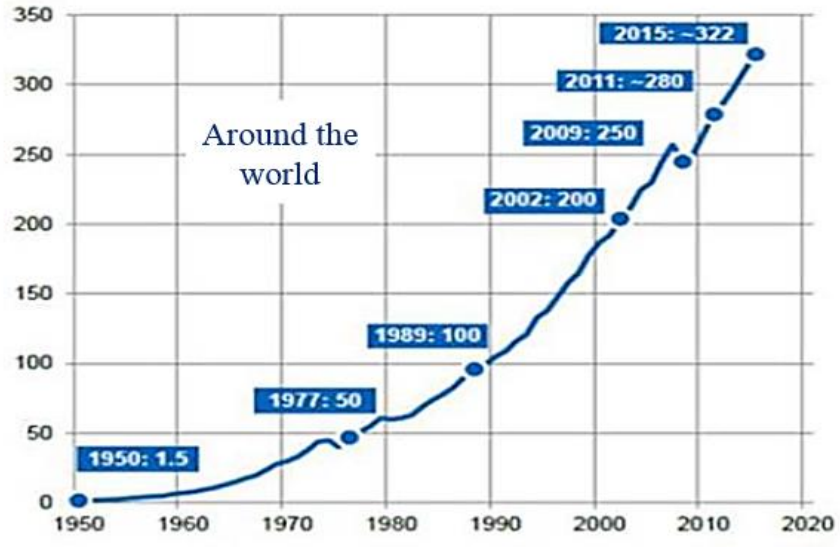

Figure 1.World wide production of plastic products (million tons) in 1950-2020

In order to minimize the negative impact of plastic packaging waste on the environment, it is necessary to take measures for effective waste management. In recent years, the country has done a lot of purposeful work in this direction, including achieving the goals of environmental protection, efficient use of natural resources, waste utilization, recycling, reuse, application of low-waste or non-waste technologies.

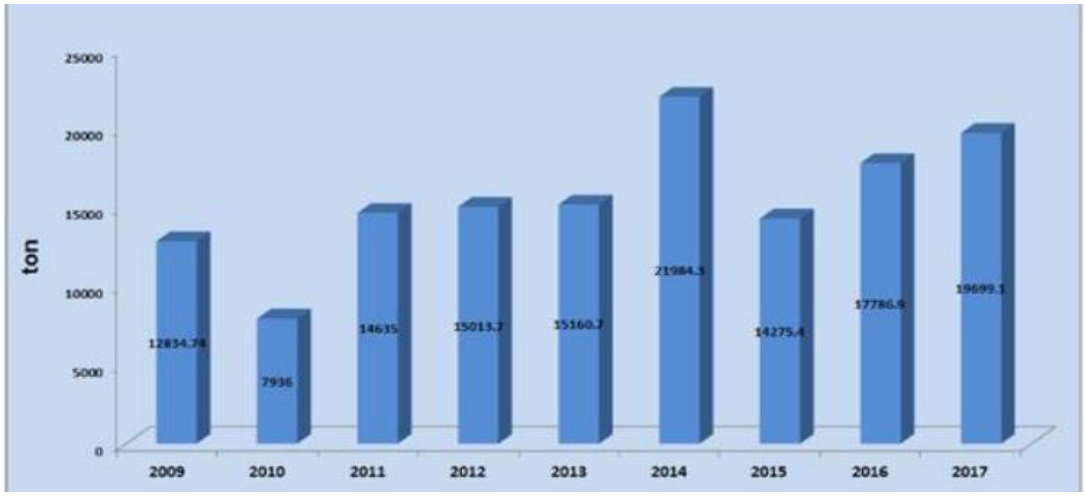

Figure 2. Plastic packaging products produced in the country in 2009-2017

Balakhani Industrial Park was established by the Order of the President of the Republic of Azerbaijan No. 1947 dated December 28, 2011 to support the establishment of processing (recycling) and service enterprises in the country. The main goal of creating this park is to provide favorable conditions for potential entrepreneurs and investors interested in the field of reproduction. In order to increase the interest of the green business, especially in the recycling industry, favorable tax incentives and infrastructure have been created for potential entrepreneurs.

In addition, the Presidential Decree No. 637 of November 1, 2018 approved the "National Strategy for Improving Solid Waste Management in the Republic of Azerbaijan for 2018-2022" in connection with the improvement of solid waste management in the country. directions have been identified.

At present, the state policy in the field of waste management in order to prevent the harmful effects of industrial and domestic wastes on the environment, to ensure the ecological balance in nature, as well as to attract such wastes to the economy as recyclables, June 30, 1998 is regulated by Law No. 514-IQ dated However, the annual increase in the volume of plastic packaging waste makes it necessary to improve the legal framework to strengthen management in this area, taking into account international experience, as well as the formation of accounting, reporting and monitoring systems, relevant economic mechanisms.

As a result of the implementation of priorities in the field of plastic packaging waste management: In 2021, the level of sorting and utilization of plastic packaging waste will increase; In 2021, the level of recycling of plastic packaging waste will increase; In 2021, the use of alternative packaging will increase.

Establishment of the necessary regulatory framework, financing, accounting and evaluation system by 2021 will strengthen the recycling sector through the effective management of special waste flows, including plastic packaging, after 2021.

The final results for 2021 will be analyzed and new targets for the collection, utilization and recycling of plastic packaging waste for the period up to 2025 will be set.

A number of modern technological projects have been launched to reduce the impact of waste in cities. In recent years, the application of "green" technologies in environmental protection, environmental issues, especially the use of alternative and renewable energy sources has become more relevant.

Here are the codes that will be available for the recycling of all waste, and processing codes are developed accordingly.

Paper (corrugated cartons)

Paper (other cartons)

Plastic

Today, fuel cells are able to make revolutionary innovations in industry, transport, as well as in the home, which is considered an energy technology. In fuel cells, steam and gases currently in operation require twice less natural gas per unit of energy compared to gas-turbine power plants.

As we know, from the first days of the modern world, like the PET bottle, the use of certain household appliances to store food, water and food is considered to be a very ideal thing to use at all times. Compared to plastics, people export and import more glass-like materials, which is why they are considered more environmentally friendly. Therefore, if we see that companies are engaged in the production of competitive milk or yogurt, it uses more glass-like and glass-like materials.

If we think about it, we see that the taste of some foods is in plastic materials, the food stored in plastic material sometimes smells and tastes, but we all know that the taste of food stored in glass containers is incomplete or incomplete. Therefore, we can see an increase in glass production.

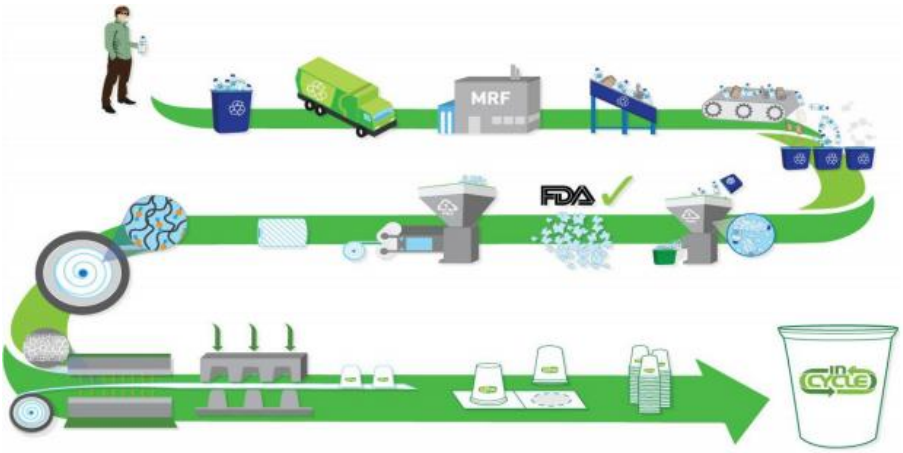

Figure 3. Scheme of recycling process of pet bottles

30-50% reduction of consumption of natural gas and oil products for electricity production, 25-40% reduction of production and operating costs, 20-30% reduction of electricity prices, increase of use of non-basic energy resources and agricultural products, harmful emissions into the atmosphere elements, including a 50% reduction in carbon dioxide. Known as “Clean City” OJSC, a pilot mechanical and semi-automatic sorting line with a capacity of 200,000 tons per year has been built to separate household waste and develop the recycling business in our city.

3. Conclusions

Thus, the article discusses the impact of plastic waste on the environment and the problems they create. In general, we come to the conclusion that work should be done to reduce plastic waste. Plastic waste has become a global problem in the world and in our country. It causes many such diseases in the human body. Projects should be developed and implemented to minimize plastic waste.

References

1.F.Aliyev, A.Badalov, E.Huseynov, F.Aliyev, Ecology, Textbook for universities. Baku: "Science", 2012.

2.A.Azizov, Waste prevention Baku p.56,2014.

3.G.Mammadov, M.Khalilov, Ecology and environmental protection. https://achiqkitab.aztc.gov.az/upl/books/pdf/Ekologiya_ve_etraf_muhitin_muhafizesi_559bac927d847.pdf

4.K.B.Bayramov, Economic and ecological problems of nature use, Baku, 2012. https://gsaz.az/ci/Kitabxana/K.B.Bayramov_Tebietden_istifadenin_idtisadi_ve_ekoloji_problemleri.pdf

5.Sh.Ahmadov, Engineering ecology, 231 p., Baku, 2012. http://sdu-sdtk.edu.az/wp-content/uploads/2020/04/B.R%C9%99na-M%C3%BCh%C9%99ndis-ekologiyas%C4%B1.pdf

6.A.Aliyev, T.Aliyev, Explanatory dictionary of terms and concepts on solid waste management - Non-Governmental Organization under the President of the Republic of Azerbaijan Public Union for Socio-Economic Research, Baku, 2012.

7.Clean city | ASC (tamizshahar.az) https://www.tamizshahar.az/az

8.www.azərsu.az

Passenger service optimization at the airport

I.Y.Bayramov

Azerbaijan State Oil and Industry University, Baku, Azerbaijan
imranb1963@mail.ru

Abstract: The article discusses the optimization of passenger service at the airport. To achieve this goal, a multi-channel, standby public service system was used, and the transfer of an incoming order to another empty channel while the channels were busy was considered. Probability formulas different from the known Erlang formulas were obtained to calculate the steady state of the system.

Keywords: Public service system, Multi-channel system, Service discipline, Service intensity, Cross-channel mutual assistance.

1.Introduction

In modern practice, there is a need to address various probabilistic issues related to the so-called mass service system (CSS) in various fields. Examples of such systems are the transportation of passengers, ticket offices, repair shops, barbershops, taxi ranks, etc. can be shown.

The process of passenger service at the airport is a system of uninterrupted public service. In this system, orders can wait in line. In addition, the number and timing of queues is unlimited. The block diagram of this type of KXS is shown in Figure 1.

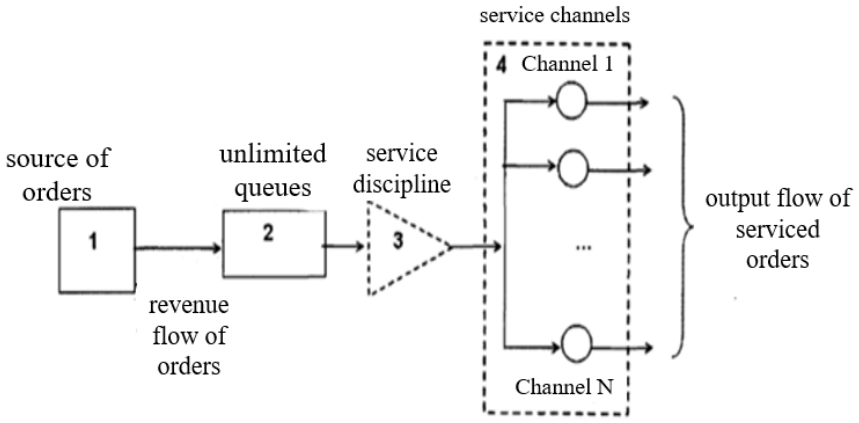

Figure 1. Block diagram of a single-phase, open-ended public service system

In this system, additional time is lost when the order is transferred from one busy channel to another empty channel.

When a particular channel is busy, the transfer of incoming orders to other arbitrary channels is due to the existing mutual assistance between the channels in the CSR, and this has certain features of mutual assistance. Ideally, it is assumed that the service intensity is the same for the order after it has been transferred from one channel to another. In this case, the Pi probability of the state of the n-channel system is expressed by the following known Erlang formula:

$$P_i = \frac{\alpha^i P_0}{i!}; \qquad i = 1,2,\dots,n \tag{1}$$

$$P_{n+r} = \frac{\alpha^r P_0}{\prod_{m=1}^{r}(n+m\beta)}; \; r = 1,2,\dots,S \tag{2}$$

$$P_0 + \sum_{i=1}^{n} P_i + \sum_{r=1}^{S} P_{n+r} = 1 \qquad (3)$$

$$P_0 = \left[\sum_{i=0}^{n} \frac{\alpha^i}{i!}\right]^{-1}$$

Here n is the number of channels connected to the work, Pi is the number of channels involved, α=λ/μ λ- load factor of n-channel system with average input intensity, μ - average service intensity in one channel, r = 1, 2, ...,S- the length of the queue corresponding to the maximum value of the number S, β=ν/μ , so that ν-is the inverse of the average waiting time.

However, in many real cases, a certain amount of time is lost during the process of transferring an order from one channel to another. That is, there is a loss of time when a passenger (order) queuing on his own channel is transferred to another channel only to be served. To compensate for this loss, the service speed on the new channel increases by Δμ<μ. In this case, the issue to be resolved can be expressed as follows:

Obtain the necessary formula for calculating the probability of Pi when providing real mutual assistance in the expected, multi-channel CSR;

To formulate the criteria for optimizing the CSR, taking into account the connection of a rational number of channels and mutual assistance between them;

Compare the results with the known results and prove the effectiveness of this proposed approach.

We assume that different order flows have the same intensities, regardless of statistics, and that each order has the same service intensity on its own channel.

We begin by calculating the complete set of events, including the existence of queues in the CSR, to calculate the necessary connections according to the classical method. We also take into account the possibility of entering orders from different channels at the entrance to the system.

K0 - all channels are empty (simple Mass Service System);

K1 - one channel is engaged in one order (mutual assistance is excluded in cases K1 and K0);

K20 - the empty channel receives two orders at the same time, so μ is served with maximum intensity (after the first order, the probability of the second coming to any channel other than the first is equal to (n-1)/n-).

K21 - two services belong to one channel. One of them is mutually transmitted to another empty channel and is served with a higher intensity - μ+ Δμ(the probability of this event occurring during the second service is equal to 1/n).

K30- The empty channel received three orders. This means that these orders will not be served on another channel (the probability that the second and third orders will fall twice on another channel is [(n-1)]^2/n).

K31 - one channel receives two orders and the other receives one order. Therefore, the second order will be served on another channel with μ + Δμ - intensity, the first and third orders will be served on the same channel and with μ - intensity (the probability of this is (2(n-1))/n^2 -). The modern development of science and technology is in the center of attention [9-15].

K32 - each of the three orders applies to the same channel. Therefore, two of them will be served on the "external" channel (the probability of this event is 1/n^2 -).

Kim -who enters the number of orders. Of these, i-m will be served on the channel with the order μ-intensity, and m-order will be served on the channel μ-Δμ-intensity on another channel.

Kn - all channels are busy.

Kn+1 - all channels are busy and one order is waiting in line. It can be serviced on any service channel (intensity μ and probability of occurrence is 1/n-if it is served on the incoming channel, and probability of occurrence of intensity μ + Δμ if it is served on another channel (n-1)/n-).

Kn+r - all channels are busy and there are r orders in turn.

Kn+s - all channels are busy and the length of the queue has reached the maximum S limit.

Thus, the main difference of the proposed approach is that some orders are served on their own channel and others on other empty channels during a more detailed review of Kim events during the service. In addition, the order waiting in line after the queue is created will not be served on its own channel.

By the same analogy, it is possible to find the Pi - probability of an event in a multi-channel, pending KXS. Multi-channel, standby CXS is calculated by the differential equation (Pi), which is likely to transmit from one channel to another. The possibility of this mutual assistance is impossible only for K0 and K1 events.

2. Experimental details

Using the procedure for constructing Kolmogorov's equations, let us construct the equations of the differential equations of the process and set these equations to zero to determine the corresponding probabilities.

$$\frac{dP_0}{dt} = -\lambda P_0 + \mu P_1$$

$$\frac{dP_0}{dt} = 0$$

by accepting

$$P_1 = \alpha P_0 \qquad (5)$$

we get.

In the next differential equation, mutual assistance must be taken into account. In this case, the second differential equation is as follows:

$$\frac{dP_1}{dt} = -(\lambda + \mu)P_1 + \lambda P_0 + P_2\left(2\mu + \frac{\Delta\mu}{n}\right)$$

$\frac{dP_1}{dt} = 0$

if we accept,

$$P_2 = \frac{\alpha^2 P_0}{2\left(1 + \frac{\Delta\mu}{2\mu n}\right)}$$

Let's differentiate the formula (6):

$$\frac{dP_2}{dt} = -\left(\lambda + 2\mu + \frac{\Delta\mu}{n}\right)P_2 + \lambda P_1 + P_3\left(3\mu + \frac{2\Delta\mu}{n}\right)$$

$\frac{dP_2}{dt} = 0$ if we accept and ignore the small limits

$$P_3 = \frac{\alpha^3 P_0}{3!\left(1 + \frac{\Delta\mu}{2\mu n}\right)\left(1 + \frac{2\Delta\mu}{3\mu n}\right)}$$

For any number of orders by the same analogy:

$$\frac{dP_i}{dt} = -\left(\lambda + i\mu + \frac{i-1}{n}\Delta\mu\right)P_i + \lambda P_{i-1} + P_{i+1}\left[(i+1)\mu + \frac{i(i+1)}{n}\Delta\mu\right]$$

Here, instead of Erlang's first formula, we get the following first new formula:

$$P_l \cong \frac{\alpha^l P_0}{i!\prod_{i=1}^{l}\left[1 + \frac{\Delta\mu(l-1)}{\mu l n}\right]} i = 1,2,\ldots,n$$

When all channels are busy, the transition equation includes the probability that the queuing service will be served on another channel. In general, we can express this equation as follows:

$$\frac{dP_n}{dt} = -\left(\lambda + 2n + \frac{(n-1)\Delta\mu}{n}\right)P_n + \lambda P_{n-1} + P_{n+1}\left[n\mu + \frac{\Delta\mu(n-1)}{n} + \nu\right]$$

$\frac{dP_n}{dt} = 0$ if we accept, then:

$$P_{n+1} \approx \frac{\alpha P_n}{n + \beta + \frac{\Delta\mu(n-1)}{\mu n}}$$

If we apply this analogy to any r order in the queue, we get the second new formula:

$$P_{n+r} \cong \frac{\alpha^r P_n}{\prod_{m=1}^{r}\left[n + m\beta + \frac{\Delta\mu(n-1)}{\mu n}\right]} \qquad (9)$$

3. Conclusions

Thus, the formulas we obtained (3), (8) and (9) are sufficient to evaluate the work of the CSR, taking into account the mutual assistance.

Note that the new formula obtained for the case $\Delta\mu=0$ is the same as the known formula, which confirms its accuracy.

References

1.A.V.Avsievich, E.N.Avsievich, Theory of queuing. Flows of requirements, queuing systems, Samara: SamGAPS, 24 p., 2004.
2.E.S.Wenzel, Operations research. M., "Soviet radio", Moscow, 1972.
3.N.Griggs, Algebraic graph theory, Cambridge University Press, Cambridge, 1993.
https://link.springer.com/chapter/10.1007/BFb0103571
4.K.R.Ahuja, K.Mehlhorn, J.B.Orlin, R.E.Tarjan, Faster Algorithms for the Shortest Path Problem, Journal of the ACM, 37:213-223, 1990.
5.RITES, Route Rationalization and Timetable Formulation Study for Bus System of Delhi. Transport Department, Government of the National Capital Territory of Delhi, 1998.
https://www.researchgate.net/publication/10633465_Transport_and_land-use_policies_in_Delhi
6.F.Rotondo, An explorative analysis to identify airport business models. Research in Transportation Business & Management, p.100417, 2019.
https://trid.trb.org/view/1672786
7.L.Adacher, M.Flamini, Optimizing Airport Land Side Operations: Check-In, Passengers' Migration, and Security Control Processes, Journal of Advanced Transportation, 2020.
https://www.researchgate.net/publication/340040381_Optimizing_Airport_Land_Side_Operations_Check-In_Passengers'_Migration_and_Security_Control_Processes

8.R.G.Abaszade, S.A.Mamedova, F.H.Agayev, S.I.Budzulyak, O.A.Kapush, M.A.Mamedova, A.M.Nabiyev, V.O.Kotsyubynsky, Synthesis and Characterization of Graphene Oxide Flakes for Transparent Thin Films, Physics and Chemistry of Solid State, Vol.22, №.3, pp.595-601, 2021.
DOI: 10.15330/pcss.22.3.595-601
9.O.A.Kapush, I.O.Mazarchuk, L.I.Trishchuk, V.Y.Morozovska, S.D.Boruk, S.I.Budzulyak, D.V.Korbutyak, B.N.Kulchitsky, O.G.Kosinov, R.G.Abaszade, Influence of the nature of the dispersion medium on the optical properties of CdTe nanocrystals during sedimentation deposition, Chernivtsi University Scientific Herald, Chemistry (819), pp.7-11, 2019.
https://doi.org/10.31861/chem-2019-819-01

10.O.Olusanya, J.Obetta, M.Oyediram, A. Elegbede, Development of a Model for International Traveler's Check-In Process Using Arena Software Tool, Engineering,12(11):811–823, 2020.
https://www.researchgate.net/publication/346487536_Development_of_a_Model_for_International_Traveler's_Check-In_Process_Using_Arena_Software_Tool

11.R.G.Abaszade, S.A.Mamedova, F.H.Agayev, S.I.Budzulyak, O.A.Kapush, M.A.Mamedova, A.M.Nabiyev, V.O.Kotsyubynsky, Synthesis and Characterization of Graphene Oxide Flakes for Transparent Thin Films, Physics and Chemistry of Solid State, Vol. 22, №3, pp. 595-601, 2021.
DOI: 10.15330/pcss.22.3.595-601
12.S.R.Figarova, E.M.Aliyev, R.G.Abaszade, R.I.Alekberov, V.R.Figarov, Negative Differential Resistance of Graphene Oxide/Sulphur Compound, Journal of Nano Research Submitted, Vol. 67, pp. 25-31, 2021.
http://dx.doi.org/10.4028/www.scientific.net/JNanoR.67.25
13.R.G.Abaszade, O.A.Kapush, S.A.Mamedova, A.M.Nabiyev, S.Z.Melikova, S.I.Budzulyak, Gadolinium doping influence on the properties of carbon nanotubes, Physics and Chemistry of Solid State, Vol.21, №3, pp. 404-408, 2020.
https://doi.org/10.15330/pcss.21.3.404-408
14.R.G.Abaszade, O.A.Kapush, A.M.Nabiyev, Properties of carbon nanotubes doped with gadolinium, Journal of Optoelectronic and Biomedical Materials, Vol.12, №3, pp. 61–65, 2020.
https://www.chalcogen.ro/61_AbaszadeRG.pdf
15.R.G.Abaszade, Analysis of carbon nanotubes, AJP Fizika, Vol.26, №2, section: Az, pp.25-29, 2020.
http://www.physics.gov.az/physart/256_2020_02_25_az.pdf

Kh.M.Popal, R.G.Abaszade, Ecoenergetics, №1, pp.65-69, 2022

Research and modeling of hybrid energy systems (review)

Kh.M.Popal, R.G.Abaszade

Azerbaijan State Oil and Industry University, Baku, Azerbaijan
popal.xp40@gmail.com , *abaszada@gmail.com*

Abstract: Half breed renewable vitality frameworks (HRES) are getting to be prevalent for inaccessible region control era applications due to propels in renewable vitality innovations and consequent rise in costs of petroleum items. Financial angles of these innovations are sufficiently promising to incorporate them in creating control era capacity for creating nations. Investigate and improvement endeavors in sun powered, wind, and other renewable vitality advances are required to proceed for, progressing their execution, building up procedures for precisely foreseeing their yield and dependably joining them with other ordinary creating sources. The paper portrays strategies to demonstrate HRES components, HRES plans and their assessment. The patterns in HRES plan appear that the crossover PV/wind vitality frameworks are getting to be picking up prevalent.

Keywords: Modeling, Hybrid energy systems, Graphene.

1.Introduction

Sun oriented and wind vitality are non-depletable, site-dependent, non-polluting, and potential sources of elective vitality. Utilization of sun based and wind control has gotten to be progressively significant, appealing and cost-effective, since the oil emergencies of early 1970s [1]. The showen article is commited to the investigation of carbon nanotubes and carbon nanotubes dopeb by gadolinium. The carbon nanotubes gotten by the electric bend strategy and the carbon nanotubes doped by ten percent gadolinium have the frame of rectangular paraleliped. At that point they are studied by the X-Ray phase analisys and Raman scattering methods and changes which are significant by these methods are carried out with mechanical properties of carbon nanotubes [2]. Some properties of carbon nanotubes which doped by gadolinium are researched and found that they are much more effective for using in alternative energy sources [3]. With different research methods it is found out that the percent of doping affects to the effectiveness [4].

In any case, common disadvantage with sun oriented and wind vitality is their eccentric nature. Standalone photovoltaics (PV) or wind vitality framework, don't create usable vitality for impressive parcel of time amid the year. Typically basically due to dependence on daylight hours, which are variable, within the previous case and on generally high cut-in wind speeds, which run from 3.5 to 4.5 m/s, within the last mentioned case coming about in under utilization of capacity [2]. In common, the varieties of sun powered and wind vitality don't coordinate with the time conveyance of request. Over the final decade, HRES have gotten to be reasonable options for control generation since they permit creator to capitalize on the qualities of both routine and renewable vitality sources. The HRES perpetually incorporates battery capacity to meet the request when either the request is crest stack request or renewable vitality source isn't accessible. Battery capacity too smoothen the jumble between time of event of crest stack and greatest control created. The HRES plan is primarily subordinate on the execution of an person framework. In arrange to anticipate execution,person components ought to be modeled first and after that their blend can be assessed to meet the request dependably. For remote areas, HRES are frequently the foremost cost-effective and solid way to deliver control. Be that as it may, sun powered and wind vitality into a HRES can constrict fluctuations in control delivered, subsequently significantly diminishing vitality capa-city prerequisites.

Modeling of hybrid renewable energy system components

Different modeling methods are created by analysts to demonstrate components of HRES. Execution of person component is either modeled by deterministic or probabilistic approaches [4]. Common technique for modeling HRES components like PV, wind, diesel generator, and battery is depicted underneath.

Modeling of photovoltaic systemThe input energy to PV system is solar radiation and total solar radiation on an inclined surface is estimated as

$$I_T = I_b R_b + I_d R_d + (I_b + I_d)R_r \quad (1)$$

Where, I_b and I_d are coordinate ordinary and diffuse sun powered radiations, Rd and Rr are the tilt components for the diffuse and reflected portion of the sun powered radiations [5]. The add up to sun oriented radiation in this way evaluated depends on position of sun within the sky, which changes from month to month. Hourly control yield from PV framework with an range Apv (m^2) on an normal day of jth month, when add up to sun based radiation of I_{Tj} (kW/m^2) is occurrence on PV surface, is given by [6]

$$P_{sj} = I_{Tj}\eta A_{PV} \quad (2)$$

A few HRES configurations such as PV–battery,

Where, Ta is the instantaneous ambient temperature,

Modeling of wind energy system.Power output of wind turbine generator at a specific site depends on wind speed at hub height and speed characteristics of the turbine. Wind speed at hub height can be calculated by using power-law equation

$$V_z = V_i\left[\frac{Z}{Z_i}\right]^x$$

where V_z and V_i are the wind speed at center and reference tallness Z and Z_i, and x is control- law exponent. Fig.1 appears ordinary wind turbine characteristics. Control yield P_w (kW/m^2) from wind turbine generator can becalculated as follows

$$P_{Wind} = \begin{cases} P_R \cdot \dfrac{v - v_c}{v_R - v_c} & \text{for } (v_c \le v \le v_R) \\ P_R & \text{for } (v_R \le v \le v_F) \\ 0 & \text{for } (v < v_c \text{ or } v > v_F) \end{cases}$$

Actual power available from wind turbine is given by

$$P = P_{wind} A_{wind} \eta$$

Where, A_{wind} is the total swept area, η is efficiency of wind turbine generator and corresponding converters. Hybrid PV frameworks are best suited to decrease reliance on fossil fuel by utilizing accessible sun powered radiations. Cross breed PV framework incorporates PV generator, diesel generator and/or battery framework. Battery capacity increments the flexibility of framework control and includes to in general framework accessibility. These vitality frame works have great prospects and numerous openings in hot climates. These vitality frameworks are named as one of the taken a toll viable arrangements to meet vitality necessities of inaccessible ranges. Financial reasonability of crossover PV framework for decentralized control era carried out and demonstrated its convenience for little towns with up to 100 families [12].

Different models counting probabilistic or deterministic approaches have been created to evaluate the execution of crossover PV framework and to find ideal blend of PV with diesel. The vitality framework modeled incorporates both, the framework with battery capacity and framework without battery capacity. Modeling battery capacity framework with regard to the state of charge, ideal measure of half breed PV framework can too be gotten [13]. El-Hefnawi [5-7] utilized a numerical method to calculate least number of capacity days and least PV cluster zone for crossover PV framework. Shrestha and Goel [5-8] illustrated a strategy to find ideal combination of PV cluster estimate and battery to meet the refrigeration stack, by utilizing measurable models for both sun based radiation and the stack.In arrange to utilize crossover wind vitality framework successfully and financially, chosen location ought to have great potential of wind vitality [25]. In addition, specialized achievability and financial reasonability ponders are to be carried out, in expansion to capacity assembly of the requests [10-14]. In arrange to anticipate the execution of wind turbine generator, determining models based on relapse examination, Monte- Carlo reenactment procedure, and neural arrange were detailed by the inquires about [9-13]. Capacity calculate of wind turbine is additionally one of the choosing parameters to select a specific sort of wind turbine at the chosen location, as an fundamental component of half breed wind framework.

Battery reinforcement in crossover wind vitality framework increments its accessibility. Elhadidy and

Shaahid [12] calculated ideal battery capacity estimate for half breed wind vitality framework by examining an affect of variety of battery capacity capacity on cross breed control era. Exchange off between estimate of the capacity capacity and diesel control required for the stack expecting a steady wind control yield was detailed by the creators. Crossover wind frameworks are too assessed on the premise of LOLP. For a given LOLP, ideal blend of wind, battery and diesel control can be gotten. Infiltration potential of wind vitality framework on a arrange premise are too detailed.

Celik [13] created simplified strategy for assessing the month to month framework execution of wind vitality frameworks. The strategy requires Weibull wind speed dispersion parameters on a month to month premise, the vitality to stack proportion and battery to stack proportion and a few demonstrate parameters as input. The demonstrate comes about in month to month independence of the framework. The approach has been found valuable for assessing the execution of the framework in nonappearance of hourly wind information.

Hybrid photovoltaic/wind energy system.A schematic graph of a stand-alone half breed PV/Wind framework is appeared in Fig.1. Battery chargers, associated to a common DC transport, are utilized to charge the battery bank from the individual PV and wind input control sources.

Depending on the battery charger innovation, the greatest accessible control can be extracted from the PV and Wind control sources (Most extreme Control Point Tracking, MPPT). The battery bank is utilized to store the vitality overflow and to supply the stack in case of moo wind speed and/or illumination conditions. A DC/AC inverter is utilized to interface the DC battery voltage to theshopper stack AC terminals are associated in parallel.

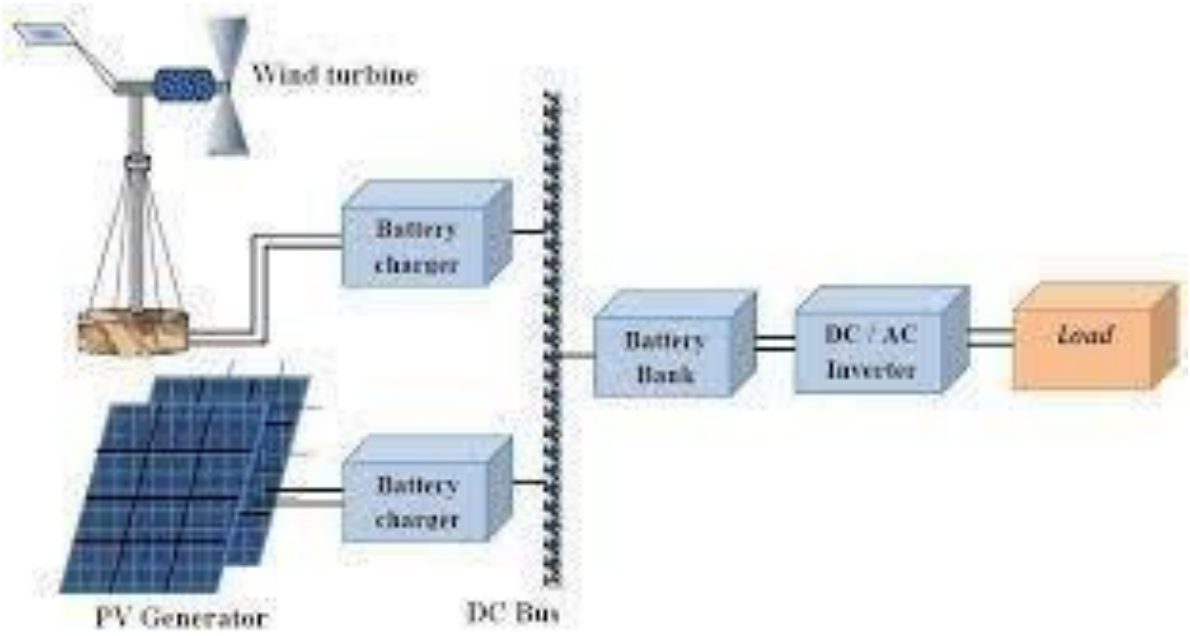

Figure 1. Hybrid energy systems

The vitality delivered from each PV or Wind source is exchanged to the consumer load through the battery charger and the DC/AC inverter, whereas the vitality overflow is used to charge the battery bank.

Standalone commercial PV or wind, don't deliver usable vitality for impressive parcel of time amid the year. Combination of PV and wind in a crossover vitality framework diminishes the battery bank and diesel prerequisites. Achievability of crossover PV/wind vitality framework unequivocally depends on sun based radiation and wind vitality potential accessible at the location. Different achievability and execution studies are detailed to assess alternative of half breed PV/ wind vitality frameworks [12,13]. PVs cluster region, number of wind machines, and battery capacity capacity play an imperative part in operation of cross breed PV/wind-diesel framework whereas fulfilling stack [1,12-14]. Nehrir et al. [9-11]

displayed computer-modeling approach for assessing the common execution of half breed PV/wind energy system. Celik [10,11] proposed a strategy to assess execution of half breed PV/wind vitality framework utilizing artificially produced climate information. Kolhe et al. [12] extravagantly examined the explanatory show for foreseeing the execution of half breed PV/wind

3..Conclusions

Distributed writing on hybrid renewable vitality frameworks (HRES) modeling demonstrates its ubiquity in terms of assembly specific vitality requests. HRESs are basically recognized for farther region control applications and are presently a days cost-effective where expansion of framework supply is costly. In spite of the fact that, the fetched and mechanical advancement of HRES in later a long time has been empowering, they stay an costly source of control. HRES gives prospects of consolidating in control era capacity to move forward control quality, due to the scattered era. This integration comes about in expanding control esteem of routine era additionally gives advertise for infiltration of renewable vitality frameworks. In arrange to present HRES in existing control supply organize, in profundity think about is to be carried out to check possibility and specialized competitiveness. Entrance levels on network basis, is long haul of half breed control framework in control era capacity of the nation, as laid out in this paper. Our research is dedicated to the study of solar panels and next-generation hybrid systems, and our research in this area continues.

References

1.M.A.Elhadidy, S.M.Shaahid, Parametric study of hybrid (wind+solar+diesel) power generating systems, Renew Energy, 21(2):129–39, 2000. https://libkey.io/10.1016/S0960-1481(00)00040-9?utm_source=ideas

2.R.G.Abaszade, Analysis of carbon nanotubes, AJP Fizika, vol XXVI №2, section: Az pp.25-29, 2020. http://www.physics.gov.az/physart/256_2020_02_25_az.pdf

3.R.G.Abaszade, O.A.Kapush, A.M.Nabiev, Properties of carbon nanotubes doped with gadolinium, Journal of Optoelectronic and Biomedical Materials vol.12, No.3, p. 61 – 65, 2020. https://scholar.google.ru/citations?view_op=view_citation&hl=ru&user=rCtORvkAAAAJ&citation_for_view=rCtORvkAAAAJ:L8Ckcad2t8MC

4.R.G.Abaszade, O.A.Kapush, S.A.Mamedova, A.M.Nabiyev, S.Z.Melikova, S.I.Budzulyak, Gadolinium doping influence on the properties of carbon nanotubes, Physics and Chemistry of Solid State pp. 404-408, 2020. https://scholar.google.ru/citations?view_op=view_citation&hl=ru&user=rCtORvkAAAAJ&citation_for_view=rCtORvkAAAAJ:qUcmZB5y_30C

5.M.A.Elhadidy, S.M.Shaahid, Promoting applications of hybrid (wind+photovoltaic+diesel+battery) power systems in hot regions. Renew Energy 29(4):517–28, 2004. https://www.researchgate.net/publication/223583939_Promoting_applications_of_hybrid_windphotovoltaicdieselbattery_power_systems_in_hot_regions

6.G.Notton, M.Muselli, A.Louche, Autonomous hybrid photovoltaic power plant using a back-up generator: a case study in a Mediterranean Island, Renew Energy, 7(4):371–91, 1996. https://doi.org/10.1016/0960-1481(96)00016-X

7.S.H.Karaki, R.B.Chedid, R.Ramadan, Probabilistic performance assessment of autonomous solar–wind energy conversion systems, IEEE Trans Energy Convers 14(3):766–72, 1999. https://www.researchgate.net/publication/224090276_Analytical_Approach_for_Well-Being_Assessment_of_Small_Autonomous_Power_Systems_With_Solar_and_Wind_Energy_Sources

8.J.A.Duffie, W.A.Beckman, Solar engineering of thermal processes, 2nd ed. USA: Wiley, 928p., 1991. https://www.sku.ac.ir/Datafiles/BookLibrary/45/John%20A.%20Duffie,%20William%20A.%20Beckman(auth.)-Solar%20Engineering%20of%20Thermal%20Processes,%20Fourth%20Edition%20(2013).pdf

9.T.Markvart, Solar electricity, 2nd ed. USA: Wiley, 298p., 2000.

https://www.wiley.com/en-us/Solar+Electricity,+2nd+Edition-p-9780471988526

10.M.A.Habib, S.SAM, El-Hadidy M.A.Al-Zaharna, Optimization procedure of a hybrid photovoltaic wind energy system, Energy, 24:919–29, 1999.
http://dx.doi.org/10.1016/S0960-1481(00)00040-9

11.M.Kolhe, K.Agbossou, J.Hamelin, T.K.Bose, Analytical model for predicting the performance of photovoltaic array coupled with a wind turbine in a stand-alone renewable energy system based on hydrogen, Renew Energy, 28(5):727–42, 2003.
https://www.researchgate.net/publication/223539799_Analytical_model_for_predicting_the_performance_of_photovoltaic_array_coupled_with_a_wind_turbine_in_a_stand-alone_renewable_energy_system_based_on_hydrogen

12.M.R.Patel Wind and solar power systems, UK: CRC Press; 350p.,1999.
https://library.uniteddiversity.coop/Energy/Wind/Wind_and_Solar_Power_Systems.pdf

13.R.Chedid, H.Akiki, S.Rahman, A decision support technique for the design of hybrid solar–wind power systems, IEEE Trans Energy Convers, 13(1), pp.76–83, 1998.
https://www.researchgate.net/publication/3269650_A_Decision_Support_Technique_for_the_Design_of_Hybrid_Solar-Wind_Power_Systems

14.O.A.Kapush, I.O.Mazarchuk, L.I.Trishchuk, V.Y.Morozovska, S.D.Boruk, S.I.Budzulyak, D.V.Korbutyak, B.N.Kulchitsky, O.G.Kosinov, R.G.Abaszade, Influence of the nature of the dispersion medium on the optical properties of CdTe nanocrystals during sedimentation deposition, Chernivtsi University Scientific Herald, Chemistry (819), pp.7-11, 2019.
https://doi.org/10.31861/chem-2019-819-01

ECO

ENERGETIKA
ENERGETICS