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ENERGY SAVING TECHNOLOGIES IN CITY LIFE

Ten Iroda Satimbayevna

Freelance applicant

at Tashkent University of Architecture and Civil Engineering

Abstract: The article discusses the types of energy-saving technologies, types of renewable energy sources, their necessity in the life of the urban population, as well as improving the ecological situation in the city with the help of energy-saving technologies.

Key words: natural component of urban space, energy-saving technologies, renewable energy sources, solar power plant, «IceWind» wind turbine.

Introduction: The natural component of urban space is of paramount importance. In our country's hot and dry climate, it is extremely difficult to walk or navigate streets lacking greenery and shade on scorching days. Tree canopies not only protect city residents from the scorching sun, but also from dust and the noise of passing public transport. They also process carbon dioxide and convert it into oxygen, which is essential for every living thing.

It is important to remember that water is the source of all life. It is thanks to water that life itself is possible. It is no wonder that since ancient times, human settlements have been built along the banks of rivers, lakes, and seas.

In Uzbekistan, where the role of natural resources, and especially water, in human and urban life is particularly significant, the presence of such sources as rivers, lakes, canals, and irrigation ditches is not only preferable but also vital in the Central Asian climate. Therefore, the formation of a living environment in places where there are water sources, structures and objects best meets the growing and increasingly complex needs of the population [1].

It is the responsibility of each of us to protect and preserve nature, minimizing human impact on it. Unfortunately, as cities grow, green spaces on streets are being replaced by gray concrete barriers and iron. Rivers are becoming polluted, trees are



being cut down, and the area of green spaces is shrinking. All of this leads to irreversible consequences.

Today, scientists around the world are searching for solutions to problems associated with air pollution caused by emissions from thermal power plants and nuclear power plants. Life in a metropolis without lighting is unimaginable. As populations grow, the demand for greater amounts of electricity increases, leading to increased government expenditures on city street lighting [2].

Materials and methods: The solution to this problem can be found in energy-saving technologies. Our country enjoys over three hundred sunny days per year. Solar energy potential amounts to approximately 51 billion tons of oil equivalent. To realize this potential, the country has committed to using renewable energy sources (RES): not only solar energy, but also energy generated by wind, hydroelectric power, biogas plants, and other sources.

According to the Decree of the President of the Republic of Uzbekistan Sh.M. Mirziyoyev dated November 28, 2013, No. PP-2078, "On measures to implement the project 'Implementation of energy-efficient technologies in the street lighting system of Tashkent' with the participation of the Islamic Development Bank," according to Appendix No. 2, approximately \$34.2 million was allocated for the project. The project was scheduled to be completed by the end of 2018. The tender was won by Uzelektroapparat LLC, an individual enterprise, which integrated dimming functionality into street lighting fixtures.

This system reduces electricity costs by regulating the current at different times of the day.

The head of our state has repeatedly noted the importance of developing renewable energy sources (RES). In his 2017 Address to the Oliy Majlis, the country's leader emphasized that, among other things, stimulating the use of alternative energy sources is essential for economic development. The "Roadmap for the Development of Solar Energy in the Republic of Uzbekistan" for 2014-2031 stipulates that solar energy should account for six percent of the country's overall energy mix by 2030. Furthermore, the signing of the Law "On the Use of Renewable Energy Sources" on May 21, 2019, has introduced incentives for the use of alternative energy in the country.



Fig. 1. Small solar power station in the Tashkent region.

One of the first steps toward transforming cities into smart cities is increasing renewable energy production. Renewable energy sources such as solar and wind can provide a significant portion of a city's energy needs, so they should be used to power buildings. Utility companies play a key role in this transformation, but they should also recognize the benefits of renewable energy. By focusing on renewable energy as a way to meet smart city needs, utilities will be able to more effectively engage with consumers and have a greater environmental impact [2].

Renewable energy sources can significantly reduce energy loss. The key for cities and public companies is to find reliable installers and suppliers of solar panels. Many solar panels currently on the market do not meet all energy efficiency requirements.

Discussion: Uzbekistan is currently working on the construction of solar power plants. For example, a 40 kW solar power plant (SPP) was commissioned in the Tashkent region on March 5, 2021 (Fig. 1). The project was funded by the Korea Energy Agency. The solar power plant produces approximately 100,000 kWh of electricity per year and is located in the Nuri Zamin mahalla.

Currently, Uzbekistan generates 85% of its electricity from thermal power plants. Thanks to the new project, the country will be able to reduce its dependence on natural gas and coal. The plant's construction will also increase the use of renewable energy sources and contribute to electricity production, which is projected to grow from 65,000 gigawatt-hours in 2019 to 103,000 GWh by 2030. [3]

The Decree of the President of the Republic of Uzbekistan dated February 16, 2023, "On measures to accelerate the implementation of renewable energy sources and energy-saving technologies in 2023" provides for the installation of solar panels at government and social facilities, as well as at gas stations (at least 50% of energy consumption from renewable energy sources), and on the roofs of new multi-story buildings. The decree encourages technological modernization—the use of energy-saving equipment, lighting control systems, and smart meters. As a result, a new culture of rational energy consumption—an important element of a sustainable city—is being developed in the economy and society.



Fig. 2. IceWind CW-1000 Wind Turbine

However, solar energy isn't the only source of light. Wind turbines, which are currently being installed in many European countries, are an example. Wind is also a renewable energy source, making it an attractive option.

Result: Undoubtedly, the downside of wind turbines is their bulk. It's impossible to install a wind farm within city limits; the blades create a lot of noise and pose a danger to both traffic and residents. A team of Icelandic scientists has found a solution to this problem. A young company called IceWind, led by Saethor Asgeirson, has proposed an innovative turbine design. The new vertical-axis wind turbine is equipped with uniquely shaped blades made of carbon fiber and stainless steel, which can withstand storm winds. At the same time, the turbine's design is quite simple. The project's creator himself says, "The turbine works simply. And generally, the simpler the system, the more reliable it is."

The company currently produces two versions of its wind turbines. The first, called the IceWind CW-1000, is designed for use in private homes or cafes. Its technical specifications allow it to generate 1000 watts of electricity at a wind speed of 10 m/s. The wind turbine comes complete with a small heat pump. Therefore, the system is capable of providing both heat and electricity for a small house. According to the manufacturer, the device is quiet, safe for birds, and its design fits into any environment (Fig. 2).



Fig. 3. IceWind RW wind turbine

The second version, IceWind RW, is designed to power telecommunications towers (Fig. 3). Its distinctive feature is a more robust design, which ensures stable operation in hurricane-force winds and icing. Models with capacities of 300, 600, and 1000 W are available, rated for wind speeds from 2 to 60 m/s.

Among other advantages of their wind turbines, the developers note a long service life (up to 30 years), low maintenance, quiet operation (up to 35 dB), and the ability to generate in any wind direction [4].



Conclusion: Cities are complex systems of interdependent energy systems. With a smart grid, a city can increase its capacity to utilize renewable energy sources such as solar and wind power, electric vehicles, and heat pumps. Furthermore, smart grids can be used to optimize energy markets, improve customer service, and enhance energy distribution technologies. Thanks to the development of wireless technologies, smart cities can take advantage of the many capabilities of smart grids.

These systems can be used in a wide range of settings, from small homes to large commercial buildings. Using data analytics allows utilities to more accurately forecast demand and bill for electricity.

Data analytics allows utilities to more effectively manage and control electricity costs. With the development of smart grids, electric utilities can improve the efficiency of their power systems. For example, with intelligent energy analytics, utilities can save on lighting, heating, and cooling. Smart grids are especially important in developing countries when deploying new energy infrastructure.

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