



**RENEWABLE ENERGY RESOURCES AND NON-CONVENTIONAL ENERGY SOURCES**

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A B S T R A C T	K E Y W O R D S
<p>In this article, information is provided about renewable energy sources, the utilization of solar energy, hydroelectric power sources, wind power plants, and energy derived from seas and oceans. This paper provides a comprehensive overview of innovative approaches for the effective deployment of renewable energy technologies.</p>	<p>Solar radiation, hydroelectric power, wind energy, wave energy, non-conventional energy.</p>

**Introduction**

Renewable Energy Sources are energy flows that are constantly present or periodically occur in the environment. Renewable energy sources include solar radiation, hydroelectric power, wind energy, biomass, sea and ocean currents, tidal energy, and geothermal energy (heat energy from the Earth's interior). The potential reserves of renewable energy sources are significantly higher than all the prospective energy needs of humanity and the potential of non-renewable energy sources (fossil and nuclear fuels). Utilizing renewable energy sources (non-conventional energy) solves the problems of reducing the reserves of non-renewable fuel-energy resources, providing long-term fuel supply to decentralized consumers and regions, and lowering its cost.

Solar radiation (the most powerful energy source on Earth) varies significantly depending on the time of day, atmospheric conditions, and season. The annual flow of solar radiation on Earth ranges from 3000 to 8000 MJ/m<sup>2</sup> (800-2200 kWh/m<sup>2</sup>). The annual amount of solar energy on the Earth's surface is 25 times greater than the energy of all proven coal reserves in the world and 3-5 thousand times greater than the energy consumed by humanity annually. In Russia, the economic potential for utilizing solar energy is equivalent to 2300 million toe, with 12.5 million toe being developed. Solar energy can be used to produce electricity by directly converting it into electrical energy using solar panels.



Hydropower Sources estimate the amount of energy that could be obtained if all the major rivers of our planet were dammed, which amounts to 9802 billion kWh, including 852 billion kWh (approximately 8.7% of the world's reserves) of Russia's hydropower resources' economic potential. China, Russia, the USA, and Brazil have the largest hydropower reserves. In Russia, the main hydropower resources (about 80%) are located in sparsely populated areas of Siberia and the Far East (about 10% developed). Therefore, the creation of large hydropower plants in these areas seems unjustified from an economic and environmental perspective (as it would lead to flooding of large areas of taiga).

The production of modern hydroelectric units with a capacity of 10-5860 kW allows the reconstruction of small hydropower plants in Russia.

The production and use of wine as an energy source has continued to grow in recent years, though it still accounts for a relatively small portion of global energy consumption. In 2024, several key trends can be observed:

**Winery waste-to-energy:** Many wineries have implemented systems to capture methane and other flammable gases produced during fermentation and use them to generate electricity or heat for winery operations. This helps reduce waste and emissions.

**Wine-based biofuels:** There is increasing research and development into using wine byproducts and distilled wine as feedstock for producing ethanol and other biofuels. A few commercial-scale wine-to-biofuel facilities are now operating, though the volumes are still modest.

**Wine as a fuel additive:** Small amounts of wine or wine components are sometimes added to conventional gasoline and diesel fuels to improve combustion properties and reduce emissions. The use of wine as a fuel additive remains niche, however.

**Household use of wine energy:** In some regions, households use small-scale wine-fired boilers or stoves for home heating and cooking. However, this remains a very minor application compared to the dominant use of natural gas, electricity, and other fuels for residential energy needs.



## **Conclusion:**

Utilizing renewable energy sources (non-conventional energy) solves the problems of reducing the reserves of non-renewable fuel-energy resources, providing long-term fuel supply to decentralized consumers and regions, and lowering its cost. Renewable and non-conventional energy sources are essential for reducing dependence on fossil fuels, mitigating climate change, and ensuring a sustainable energy future. Their development and integration into the energy mix can address environmental concerns and provide long-term energy security.

The implementation of these innovative approaches can significantly contribute to the widespread adoption of renewable energy and the achievement of sustainable energy goals. Further research and development in these areas are essential for the continued advancement of renewable energy solutions.

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