NP JSC **"South Kazakhstan University named after M. Auezov"**

"Affordable and clean energy"

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Introduction

Energy is one of the foundations of modern civilization. Access to clean and affordable energy is critical to ensuring sustainable economic growth and improving the quality of life. The purpose of this paper is to consider the importance of clean energy development, the main problems associated with traditional energy sources, and ways to transition to sustainable solutions. Solar energy is one of the fastest growing sources of renewable energy, increasing its share in the global energy mix every year.

Problems of traditional energy sources

Traditional energy sources such as oil, coal and natural gas remain dominant, but their use leads to a number of problems:

- **Environmental pollution.** The burning of fossil fuels leads to emissions of carbon dioxide (CO2), which is the main cause of global warming and climate change.

- **Depletion of natural resources.** Fossil fuels are non-renewable resources and their reserves are gradually being depleted.
- **Economic risks.** Fluctuations in oil and gas prices can lead to energy crises and negatively affect the economies of fuel importing countries.

In some countries, the share of coal-fired power in the energy mix exceeds 70%, which significantly increases greenhouse gas emissions.

The benefits of low-cost and clean energy

Switching to clean energy offers many advantages:

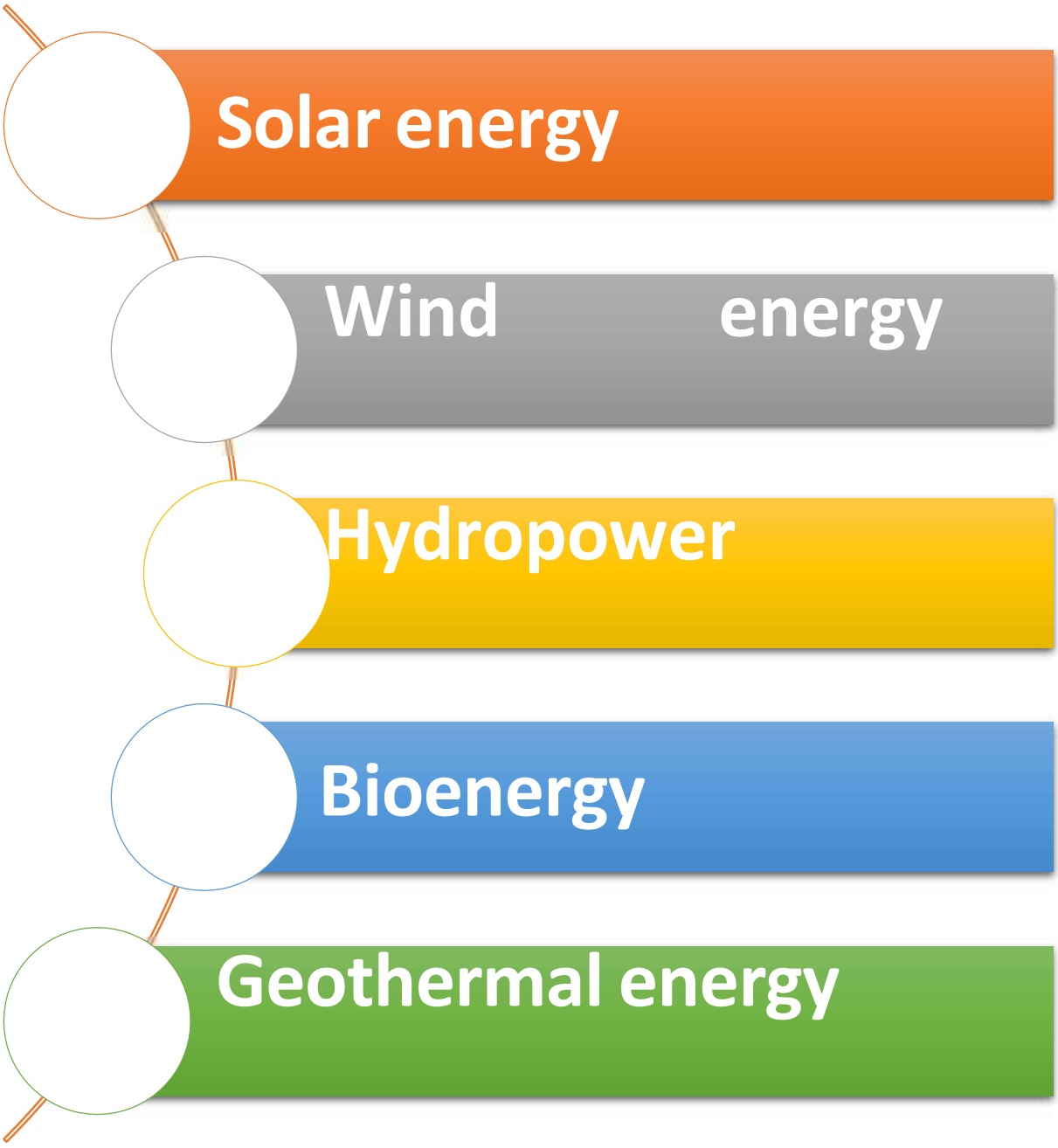
- **Reducing greenhouse gas emissions.** Renewable energy sources such as solar and wind do not produce significant CO2 emissions**.**

- **Long-term savings.** Despite the initial investment in infrastructure the operating costs of clean energy are often lower than those of traditional sources.

- **Increasing energy independence.** The use of renewable resources available locally reduces dependence on fossil fuel imports.

The main sources of clean energy

Low-cost and clean energy sources include:



- **Solar energy.** Solar panels convert light into electricity and can be used both in large power plants and at home.

- **Wind energy.** Wind farms are installed both onshore and offshore. Wind turbines use kinetic wind energy to generate electricity.

- **Hydropower engineering.** It uses the energy of falling water to generate electricity and is one of the oldest forms of renewable energy.

- **Bioenergy.** It includes the use of biomass and biofuels for energy production.

- **Geothermal energy.** It is based on the use of Earth's heat to heat buildings and generate electricity.

Ways to transition to clean energy

The transition to clean energy requires measures at various levels: **Government support and subsidies**. The development and implementation of laws aimed at encouraging the use of renewable sources can accelerate the transition process.

Investments in scientific research. New technologies, such as more efficient solar panels or improved energy storage methods, can make clean energy more affordable.

The transition to electrification. The use of electric cars and the transition to electric heating helps to reduce emissions from the transport and housing sectors. In some countries, such as Denmark, the share of wind energy in total electricity generation already exceeds 40%.

Examples of successful transitions to clean energy

Germany. The Energy Transition program in Germany aims to increase the share of renewable sources to 80% by 2050.

Iceland. Almost all electricity in Iceland is produced from hydro and geothermal sources.

China. The largest producer of solar energy in the world, actively investing in solar and wind power plants.

The role of universities

Universities and schools can make a significant contribution to the promotion of clean energy:

- **Research and innovation.** Implementation of scientific projects on the development of new technologies and methods of energy generation.
- **Educational programs.** Programs aimed at educating students on sustainable development and renewable energy sources are shaping a new generation of environmentally conscious professionals.
- **Energy efficiency on campuses.** The use of solar panels, wind turbines and other renewable sources to provide energy to university buildings.
- **Educational work.** Universities can organize seminars, lectures and actions to raise awareness about environmental issues.

The transition to low-cost and clean energy is not just a technical issue, but also an important element of sustainable development and the fight against climate change. It requires joint efforts on the part of governments, business, educational institutions and society as a whole.

The University of California, Berkeley studies and develops new technologies for clean energy, including solar, wind and geothermal.

The University of Cambridge in the UK has made significant progress in energy conservation by improving energy efficiency and reducing carbon emissions. The University actively uses renewable energy sources and modernizes energy efficiency systems.

The buildings to enhance their University of California at San Diego are an example of how a large university can become a leader in sustainable energy. The campus is powered by 100% renewable energy sources and is actively engaged in the development of energy storage technologies.

The use of renewable energy sources: Many universities around the world are actively implementing solar panels, wind turbines and geothermal systems to meet some of their energy needs. Some universities, such as the University of California at Berkeley, use solar panels to reduce carbon emissions and reduce energy costs.

Energy efficiency of buildings: Universities have to modernize their buildings, improve thermal insulation, install energy-efficient heating, ventilation and air conditioning (HVAC) systems, as well as implement smart lighting systems. For example, the University of Edinburgh has implemented smart sensors to monitor and manage energy consumption in academic buildings.

Proposed measures of the South Kazakhstan University named after M. Auezov

Smart Campuses with IoT integration: Implementation of an Internet of Things (IoT)-based smart energy management system that automatically adjusts energy consumption in real time depending on the load on buildings. For example, the use of motion sensors to turn on and off lights, automated windows to adjust temperature and ventilation depending on weather conditions.

Energy efficiency competitions: Organization of annual competitions among students of higher schools and faculties on the development and implementation of energy efficiency and use projects to increase renewable energy sources in university buildings. For example, the creation of projects for "green" roofs or the installation of mini-hydroelectric power plants on the river flowing through the campus.

Green transport infrastructure: The introduction of a system of electric charging stations for students and university staff, as well as the use of electric buses and bicycles to reduce the need for carbon emissions and save energy on transport. The University also encourages the use of electric vehicles by providing parking discounts for owners of such cars.

The Carbon-Free Campus Program: The implementation of an ambitious program to achieve carbon neutrality on campuses. This may include not only switching to renewable energy sources, but also the introduction of a carbon offset system through reforestation, tree planting and other measures.