RENEWABLE ENERGY – TECHNOLOGY FOR THE FUTURE

*Vu Duc Thang – 20224330*

# GENERAL INTRODUCTION

## Define​

* Definition: Renewable energy is the type of energy that can be replenished in a short timeframe, derived from natural sources such as sunlight, wind, water, and biomass.
* Importance:
  + Minimize greenhouse gas emissions, contributing to mitigating climate change.
  + Reduce dependency on finite natural resources like fossil fuels.
  + ​Promote sustainable development, creating jobs and strengthening the economy.

## Types of Renewable Energy

Renewable energy can be categorized based on the mechanisms of energy conversion and support systems, including:

* Solar Energy: Using photovoltaic (PV) systems or solar thermal designs to convert sunlight directly into electricity.
* Wind Energy: Generating electricity with wind turbines in areas with strong and consistent winds.
* Hydropower: Utilizing the flow of water to drive turbines, converting kinetic energy into electricity.
* Biomass Energy: Transforming organic materials, such as agricultural residues, into energy through combustion or fermentation.
* Geothermal Energy: Harnessing heat from beneath the Earth's surface for energy production.
* Ocean Energy: Including tidal and wave energy, which converts water movements into electricity.

## Renewable Energy Transmission Process

Based on Figure 1, we can observe a simplified process of renewable energy transmission. Renewable energy sources, once harnessed, are transmitted to energy storage facilities. If the initial energy source is DC, it will pass through an inverter to convert DC to AC before being transmitted to the storage facility. Subsequently, the energy can be supplied to users or integrated into the power grid.

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Figure 1 – Renewable energy transmission process

# ADVANTAGES AND DISADVANTAGES OF RENEWABLE ENERGY RESOURCE

Renewable energy is environmentally friendly, reduces greenhouse gas emissions, and provides sustainable power. However, it faces challenges like intermittency, high initial costs, and expensive energy storage. Despite these, its long-term benefits make it essential for the future. Table 1 showed advantages and disadvantages of renewable energy.

Table 1 – Advantages and Disadvantages of Renewable Energy

|  |  |  |  |
| --- | --- | --- | --- |
| **Oder** | **Renewable Energy** | **Advantage** | **Disadvantage** |
| 1 | Solar Energy | Abundant source, low operational costs, eco-friendly | High initial costs, weather-dependent |
| 2 | Wind Energy | Cost-effective, no greenhouse gas emissions | Noise pollution, impacts on ecosystems |
| 3 | Hydropower | Stable energy source, high storage capability | High construction costs, ecological impacts |
| 4 | Biomass Energy | Reduce waste, utilizes available resources | Require large land area, emissions burning |
| 5 | Geothermal Energy | Stable supply, not weather-dependent | High extraction costs, limited to specific |
| 6 | Ocean Energy | Predictable, vast potential | High costs, impacts on marine environments| |
|  |  |  |  |

# CHALLENGES IN DEVELOPMENT

Renewable energy is becoming increasingly important globally due to technological advancements, lower costs, and growing environmental concerns. However, its overall capacity remains small compared to traditional energy sources. Even developed countries still rely heavily on coal, oil, gas, and nuclear power due to the intermittency and reliability issues of renewables. Energy generation from renewable sources doesn’t always match demand, and energy storage solutions remain costly. Additionally, the high initial costs and challenges in grid stability require traditional power plants to balance supply, while upgrading the power grid is time-consuming. All mentioned in [1].

## Intermittency and Storage Challenges:

Renewable energy sources like solar and wind are intermittent, producing energy inconsistently due to weather and time variations. This mismatch between energy generation and demand requires expensive energy storage solutions and backup from traditional power plants to stabilize the grid, increasing overall system costs.

## High Initial Investment Costs:

Renewable energy projects often require significant upfront capital for installation and infrastructure, making them more expensive initially than traditional energy sources. This is a major barrier for developing countries and small-scale projects, although costs are gradually decreasing due to technological advancements.

## Infrastructure and Grid Limitations:

Current energy grids are designed for stable, centralized power sources and struggle to integrate variable and decentralized renewable energy. The lack of large-scale energy storage and grid upgrades makes it challenging to manage fluctuating renewable output, requiring backup systems and adding complexity to grid management.

# RENEWABLE ENERGY IN VIET NAM

According to [2], Vietnam is actively working to transition from traditional energy sources, primarily coal and oil, to renewable energy to support sustainable development and reduce environmental impacts. Despite its significant advantages and great potential for renewable energy development, Vietnam still faces various challenges in this transition. According to the National Electricity Development Plan, the country aims to achieve a renewable energy share of 15-20% by 2030 and 20-30% by 2045. Currently, coal and hydropower remain the main energy sources due to their stability and cost-effectiveness. However, increasing investment in renewable energy, leveraging Vietnam's geographical and natural strengths, will enable the country to better secure its energy supply for economic growth.

## Potential for development of renewable energy industry

* Solar Energy Potential:
* Vietnam has the highest solar energy potential in Southeast Asia.
* Over 2,500 hours of sunlight annually, especially in central and southern regions.
* Large areas of vacant land are suitable for solar power plants.
* Government incentives attract investment in renewable energy.
* Wind Energy Potential:
* A 3,200 km coastline with high wind speeds favors wind power development.
* Installed wind power capacity reached over 7 GW by November 2023.
* Major projects: La Gan (4 GW), Mui Dinh (3.5 GW), Thang Long (2 GW).
* Wind energy is becoming a key part of Vietnam's renewable energy mix.
* Hydropower Potential:
* Mountainous terrain, rivers, and high rainfall support hydropower growth.
* Total hydropower capacity exceeds 23 GW, over 40% of national power.
* Key plants: Hoa Binh, Son La, Lai Chau, and Yaly.
* Hydropower aids flood control, drought mitigation, and tourism.

## Challenges need to be overcome to develop renewable energy

* Infrastructure and Technology Investment:

Vietnam needs significant investment in infrastructure and technology, especially in energy storage and distribution, to fully develop its renewable energy potential. The current power grid is not capable of supporting large-scale renewable energy projects, making it difficult to integrate clean energy sources into the national grid.

* High Initial Costs and Funding Needs:

Although the cost of renewable energy production has decreased, the initial investment for solar and wind power projects remains high. To overcome this challenge, Vietnam must promote funding opportunities and attract more investment to support the growth of renewable energy.

* Policy and Regulatory Improvements:

Vietnam must adjust its policies and regulations on renewable energy to create a more stable and attractive investment environment. Clear legal frameworks and supportive policies will help attract both domestic and foreign investors to this sector.

* Technological Efficiency and Human Resources:

Renewable energy technologies in Vietnam are still less efficient than traditional energy sources. Therefore, it is crucial to invest in research and development to improve efficiency and reduce costs. Additionally, enhancing the skills and qualifications of the workforce in the renewable energy industry is necessary for sustainable growth.

* Impact of Climate Change:

Climate change poses risks to the development of renewable energy, particularly for wind and hydropower projects. Careful evaluation and planning are needed to ensure these projects operate efficiently and are resilient to environmental changes.

* Importance of Renewable Energy:

Despite these challenges, renewable energy is vital for ensuring Vietnam’s energy security and environmental protection. By fully utilizing renewable energy resources, Vietnam can progress toward sustainable development and contribute to global efforts to combat climate change.

# CONCLUSION

In conclusion, renewable energy represents the future of global power generation, providing a sustainable solution to combat climate change and ensure energy security. With advancements in technology and declining costs, renewable energy sources such as solar, wind, and hydropower are becoming increasingly viable alternatives to traditional fossil fuels. Across the globe, nations are recognizing the importance of transitioning to renewable energy to safeguard the environment and build a more resilient and sustainable economy. For Vietnam, the abundance of natural resources and the government's commitment to renewable energy make it a prime candidate for accelerating the transition. By investing in infrastructure, innovation, and supportive policies, Vietnam can unlock the full potential of renewable energy to meet its growing energy demands while contributing to global climate goals and fostering long-term economic growth.

# REFERRENCE

[1] Mateusz Brodowicz (2024, June 23). *Challenges and Opportunities in the Field of Renewable Energy* [Online]. Available: <https://aithor.com/essay-examples/challenges-and-opportunities-in-the-field-of-renewable-energy#2-challenges-in-renewable-energy>

[2] Mr. Nguyen Cong Dung (2024, March 3*). Potential and challenges for renewable energy industry in Vietnam* [Online]. Available: <https://en.dangcongsan.vn/trade-investment/potential-and-challenges-for-renewable-energy-industry-in-vietnam-20000816.html>

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