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Navigating the Future Energy Landscape A Comprehensive Review of Policy Recommendations for Renewable and Nonrenewable Sources in the United States

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ABSTRACT

The future energy landscape of the United States is at a critical juncture, necessitating a comprehensive review of policy recommendations for renewable and nonrenewable energy sources. This article explores the evolving dynamics of the U.S. energy sector, emphasizing the need for sustainable and reliable energy sources. It delves into the current energy mix, featuring both renewable and nonrenewable sources, while offering a nuanced analysis of their roles in shaping the nation's energy policies. The policy recommendations for renewable energy underscore the importance of investment in infrastructure, incentives, research and development, emission reduction targets, and community engagement. In contrast, policy recommendations for nonrenewable sources emphasize carbon capture and storage, energy efficiency standards, diversification, and a just transition for workers. As the nation stands on the cusp of transformative change, these recommendations are crucial to navigate the complexities of the energy landscape. They offer guidance for policymakers, industry leaders, and communities, ensuring the transition towards sustainability and environmental responsibility. The choices made today will resonate for generations to come, as the United States charts a course towards a resilient, sustainable, and greener energy future.

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Introduction

The energy landscape of the United States is at the cusp of a significant transformation. As the nation grapples with the pressing issues of climate change, carbon emissions, and the imperative for sustainability, the question of energy sourcing and policy formulation has never been more critical. The United States finds itself standing at the crossroads, with an urgent need to evaluate the role of both renewable and nonrenewable energy sources in shaping the nation's future [1].

This article embarks on a journey to explore the ever-evolving energy panorama, offering a comprehensive review of policy recommendations for both renewable and nonrenewable sources. It seeks to shed light on the nuances, challenges, and opportunities inherent in the nation's quest for a sustainable and dependable energy future [1].

Before delving into the policy recommendations, it is essential to examine the current energy mix, as it serves as the backdrop against which these recommendations are formulated. This energy mix encompasses a diverse array of sources, each with its unique contributions and implications for the environment, economy, and society.

The following pages will unveil the intricacies of the policy recommendations for renewable energy, emphasizing the need for investment, incentives, research, emission reduction, and community engagement. Additionally, it will delve into the policy recommendations surrounding nonrenewable sources, exploring avenues for carbon capture and storage, enhanced energy efficiency, diversification, and the just transition for workers.

As the nation charts a course towards a more sustainable and reliable energy future, these policy recommendations offer invaluable insights and guidance to policymakers, industry leaders, and local communities. The choices made today will reverberate through generations, shaping the United States into a bastion of resilience, sustainability, and environmental responsibility.

Renewable and Nonrenewable Source of Energy

In the context of renewable energy, the term "source" typically refers to the natural resources or elements that are harnessed to generate clean and sustainable energy. These sources are considered renewable because they are naturally replenished over time and do not deplete when used for energy production. The main sources of renewable energy include

- **Solar Energy:** Derived from the sun's radiation, solar energy is harnessed through photovoltaic (PV) cells or solar panels to convert sunlight into electricity. It is one of the most abundant and widely used sources of renewable energy.
- **Wind Energy:** Wind turbines capture the kinetic energy of moving air to generate electricity. Wind energy is an

increasingly popular source of renewable power, especially in areas with consistent wind patterns.

- **Hydropower:** Also known as hydroelectric power, this energy source uses the gravitational force of falling or flowing water to turn turbines and produce electricity. It is a well-established form of renewable energy with hydropower plants located in various regions.
- **Biomass Energy:** Biomass refers to organic materials like wood, agricultural residues, and waste that can be converted into energy through processes like combustion, gasification, or biofuel production. It is a versatile source of renewable energy.
- **Geothermal Energy:** Geothermal power harnesses heat from the Earth's core to generate electricity or provide direct heating. It is a reliable and constant source of renewable energy, often used in geologically active areas.
- **Tidal and Ocean Energy:** Tidal and ocean energy technologies capture the movement of ocean tides, waves, and currents to generate power. These sources have the advantage of predictability and sustainability.
- **Hydrogen:** While not a primary energy source in itself, hydrogen can be produced through renewable energy, such as electrolysis using electricity from wind or solar sources. It is considered a clean and versatile energy carrier.

These renewable energy sources are essential in reducing greenhouse gas emissions and addressing environmental concerns associated with nonrenewable sources, like coal, oil, and natural gas. As technology advances and the energy landscape evolves, the role of these renewable sources in meeting energy demands is expected to continue growing.

Nonrenewable sources of energy are energy resources that cannot be naturally replenished or regenerated on a human timescale. These sources are finite, and once they are depleted, they cannot be readily replaced. Nonrenewable energy sources include

Fossil Fuels

Fossil fuels, which include coal, oil, and natural gas, have long been the backbone of global energy production. These nonrenewable resources have powered economies, transportation, and industries for generations. However, they come with environmental concerns, including greenhouse gas emissions that contribute to climate change. As the world seeks cleaner and more sustainable energy sources, the role of fossil fuels is under scrutiny. Transitioning away from fossil fuels toward renewable and low-carbon alternatives is a crucial step in addressing environmental challenges and securing a more sustainable energy future.

- a. **Coal:** Coal is a carbon-rich sedimentary rock that, when burned, releases energy in the form of heat and electricity. It has been a primary source of energy for centuries, but it is a major contributor to carbon dioxide emissions and air pollution.
- b. **Oil (Petroleum):** Oil is a liquid hydrocarbon extracted from underground reservoirs. It is used for various purposes, including transportation, heating, and as a feedstock for petrochemicals.
- c. **Natural Gas:** Natural gas is primarily composed of methane and is often used for heating, electricity generation, and as a fuel for vehicles.

Nuclear Energy

Nuclear energy is generated through the fission of uranium or

plutonium atoms in nuclear reactors. While it does not produce greenhouse gas emissions during electricity generation, it comes with concerns related to nuclear waste disposal and safety.

Nonrenewable energy sources have historically been the dominant contributors to global energy production due to their energy density and ease of use. However, their finite nature and associated environmental and climate change concerns have led to a growing emphasis on transitioning to renewable energy sources to reduce carbon emissions and promote sustainability. Transitioning to cleaner, more sustainable energy options is a crucial aspect of addressing environmental and energy-related challenges in the modern world.

Is Nuclear Fission Energy Nonrenewable Source?

Nuclear energy is a somewhat complex case when it comes to categorizing it as either renewable or nonrenewable. It is often considered a nonrenewable source due to the finite nature of the fuel used in nuclear reactors, which is typically uranium-235 or plutonium-239. These fuel sources are finite and can be depleted, much like fossil fuels.

However, there is an important distinction to be made. While the specific fissile materials used in nuclear reactors are finite, the potential for nuclear energy to be considered more sustainable and less damaging to the environment compared to traditional nonrenewable sources like coal, oil, and natural gas is noteworthy.

Nuclear energy has some unique characteristics

- **Low Greenhouse Gas Emissions:** Nuclear power plants produce electricity with minimal greenhouse gas emissions, making them a cleaner energy option in terms of carbon emissions.
- **Continuous Power Generation:** Nuclear reactors can provide a consistent and stable source of electricity, unlike some renewable sources such as wind and solar, which can be intermittent.
- **Reduced Resource Consumption:** Nuclear reactors use fuel very efficiently. A small amount of nuclear fuel can produce a significant amount of energy over an extended period.
- **Advanced Technologies:** Emerging nuclear technologies, such as breeder reactors and thorium reactors, have the potential to extend the availability of nuclear fuel and further reduce waste.

However, nuclear energy is not without its challenges and drawbacks. Concerns include the long-term management of radioactive waste, potential accidents, and the proliferation of nuclear weapons. The safety of nuclear power plants and the disposal of nuclear waste are significant issues that must be addressed to ensure the responsible use of this energy source.

In summary, nuclear energy is often considered nonrenewable due to the finite nature of its fuel source, but it occupies a unique space in the energy landscape as a low-carbon and efficient energy option. It is a part of the broader discussion on sustainable and clean energy sources.

Where Nuclear Fusion Energy Source Stands?

Nuclear fusion is a promising and exciting potential energy source that stands apart from both renewable and traditional nonrenewable energy sources. Nuclear fusion has the potential to provide abundant, clean, and sustainable energy, and it differs significantly from the traditional nonrenewable sources like fossil

fuels and uranium-based nuclear fission. Here's where nuclear fusion stands in the context of energy sources

- **Renewability:** Nuclear fusion is often considered a virtually unlimited and sustainable source of energy. It is based on the process that powers the sun and other stars, where atomic nuclei combine to release energy. The primary fuel for nuclear fusion on Earth is isotopes of hydrogen, specifically deuterium and tritium, which are widely available.
- **Clean Energy:** Nuclear fusion produces energy without emitting greenhouse gases, and its fuel supply is not associated with the environmental and safety concerns of traditional nuclear fission (e.g., radioactive waste and the risk of meltdowns).
- **Safety:** Fusion reactions are inherently safe. In the event of any operational issue or equipment failure, the reaction stops without the risk of a catastrophic nuclear meltdown.
- **Fuel Abundance:** Deuterium, one of the primary fuels for nuclear fusion, can be extracted from water, and tritium can be produced from lithium, which is abundant. This contrasts with limited reserves of uranium and the finite nature of fossil fuel resources.
- **High Energy Density:** Nuclear fusion offers extremely high energy density, meaning a small amount of fuel can produce a substantial amount of energy. This could make fusion an efficient and compact energy source.

However, it's important to note that nuclear fusion has faced significant technical challenges, primarily related to the high temperatures and pressures required to sustain the fusion reaction. Scientists and engineers are working on developing and harnessing controlled nuclear fusion, which has been a work in progress for many years.

Projects such as the ITER (International Thermonuclear Experimental Reactor) in France are at the forefront of fusion research and aim to demonstrate the feasibility of sustained nuclear fusion. While significant progress has been made, commercial fusion power plants are not yet a reality.

In summary, nuclear fusion represents an exciting prospect for the future of clean, sustainable energy. It stands out as a potential game-changer, offering the advantages of renewable energy sources and avoiding the drawbacks of traditional nonrenewable sources. However, it remains a technology under development, and its full integration into the global energy landscape is a goal for the future.

The Current Energy Mix

The United States has long been reliant on nonrenewable energy sources, primarily fossil fuels such as coal, oil, and natural gas. While these resources have powered the nation's economic growth, they have also been responsible for a substantial share of greenhouse gas emissions and environmental degradation.

Over the past few decades, there has been a significant shift toward cleaner, renewable energy sources, such as solar, wind, and hydropower. These sources have gained prominence due to their lower carbon footprint and sustainability. The transition to renewable energy has been driven by technological advancements, decreasing costs, and growing public concern for the environment.

Policy Recommendations for Renewable Energy

Write a brief summary Policy Recommendations for Renewable Energy

- **Carbon Capture and Storage (CCS):** Promoting the

development and implementation of CCS technologies can reduce the carbon footprint of nonrenewable energy sources, making them less environmentally harmful.

- **Energy Efficiency Standards:** Implementing and enforcing stringent energy efficiency standards for nonrenewable energy production and consumption can reduce wastage and environmental impact.
- **Diversification of Energy Sources:** Encourage diversification within nonrenewable sources, such as transitioning from coal to cleaner natural gas. This can be a transitional strategy while reducing emissions.
- **Investment in Nuclear Energy:** Supporting nuclear energy as a low-carbon alternative can play a crucial role in the energy mix, provided safety and waste management concerns are addressed.
- **Just Transition for Workers:** As the nation transitions to cleaner energy sources, it is essential to ensure a just transition for workers in the nonrenewable energy sector, including retraining and support for new job opportunities.

The policy recommendations for renewable energy are crucial in guiding the United States toward a more sustainable and dependable energy future. They encompass a range of strategies and actions that promote the development and utilization of clean and renewable energy sources. These recommendations include

- **Investment in Infrastructure:** To support the expansion of renewable energy, substantial investments are needed in the electrical grid, energy storage, and distribution systems to accommodate the intermittent nature of renewables and ensure reliable supply.
- **Incentives and Tax Credits:** The continuation of federal and state-level incentives and tax credits is essential to make renewable energy projects economically viable and encourage private sector investments.
- **Research and Development:** Ongoing investments in research and development are crucial to advance renewable energy technologies, making them more efficient, cost-effective, and scalable.
- **Emission Reduction Targets:** Setting clear and ambitious emission reduction targets at the federal level provides a roadmap for transitioning to renewables and guides states in developing their renewable energy policies.
- **Community Engagement:** Encouraging community-level renewable energy projects empowers local communities, stimulates economic growth, and fosters a sense of ownership over the transition to renewable energy.

These policy recommendations collectively aim to accelerate the transition to renewable energy, reduce greenhouse gas emissions, and create a more sustainable and environmentally responsible energy sector in the United States.

Conclusion

The United States faces a defining moment in its energy history. The transition to a sustainable and reliable energy future requires a careful balancing act between renewable and nonrenewable sources. While renewables hold the promise of a cleaner, greener future, nonrenewable will continue to play a role in the transition.

The policy recommendations discussed in this article provide a roadmap for policymakers, industry leaders, and communities to navigate the future energy landscape successfully. By prioritizing the development of renewables, investing in research, and carefully managing the decline of nonrenewable sources, the United States

can ensure a resilient, sustainable, and environmentally responsible energy future. The choices made today will have a lasting impact on generations to come [2-4].

Moreover, the future energy landscape of the United States is poised at a critical juncture, where the choices made today will shape the nation's path towards sustainability, reliability, and environmental responsibility. The examination of both renewable and nonrenewable energy sources within this article illuminates the complex interplay of factors that must be considered in the development of effective energy policies.

Policy recommendations for renewable energy, spanning investment, incentives, research, emissions targets, and community engagement, offer a roadmap to a cleaner, greener energy future. These recommendations are essential in fostering a transition that not only reduces greenhouse gas emissions but also empowers local communities and spurs economic growth.

In the case of nonrenewable sources, the article underscores the challenges of finite resources and the need for a diversified and efficient approach. Whether through carbon capture and storage or a just transition for workers, the responsible management of nonrenewable energy sources remains a critical aspect of the transition.

As we stand at the precipice of transformative change, it is abundantly clear that the energy landscape must evolve. The recommendations presented in this article provide valuable insights for policymakers, industry leaders, and local communities, offering a path forward towards a more sustainable, resilient, and environmentally responsible energy future. The journey towards this future will demand thoughtful, strategic decisions that honor the needs of the present while securing the prosperity and well-being of future generations.

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