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Empowering the future: Green energy technology

Anki Mibang, Kasinam Doruk, Sanchung Lida, Akli Nabam and Karge BasarDOI: <https://doi.org/10.22271/phyto.2024.v13.i1e.14851>**Abstract**

The future of green energy technology holds the potential to empower society and the environment. Through innovation and sustainable practices, it aims to reduce dependency on fossil fuels, mitigate climate change, and create a more resilient energy infrastructure. This empowerment comes from the ability to harness renewable energy sources such as solar, wind, and hydroelectric power, while advancing energy storage and distribution systems. By embracing green energy technology, we empower the future with a clean, sustainable, and efficient energy landscape that benefits both current and future generations.

Keywords: Green energy technology, renewable sources, empowerment**Introduction**

The global pursuit of sustainable energy solutions has paved the way for the remarkable evolution of green energy technology. This paradigm shift is fuelled by the pressing need to address climate change, reduce reliance on finite fossil fuel reserves, and build a more sustainable energy infrastructure. Green energy technology encompasses a diverse array of innovative solutions, including solar, wind, hydroelectric, and geothermal power, as well as advancements in energy storage and efficient distribution systems. Green energy technology holds the key to empowering the future by providing sustainable and renewable alternatives to traditional energy sources. As the world faces numerous challenges such as climate change and the depletion of fossil fuels, the need for green energy technologies becomes increasingly critical. These advanced technologies harness naturally occurring sources of energy, such as sunlight, wind, and water, to generate clean electricity and mitigate the environmental impact of energy production (Prindle *et al.*, 2020) ^[9].

One of the most prominent green energy technologies is solar power. Solar panels convert sunlight into electricity, providing a reliable and renewable energy source. According to the International Energy Agency (IEA), solar photovoltaic (PV) capacity grew by 22% in 2020, with solar power becoming the cheapest source of electricity in history in some regions (IEA, 2021) ^[6]. Solar power not only reduces greenhouse gas emissions but also offers energy independence and resilience, particularly in areas with limited access to traditional power grids.

Wind energy is another significant green technology. Wind turbines convert the kinetic energy from wind into electrical energy, providing a reliable and low-emission power source. The Global Wind Energy Council (GWEC) reported that the cumulative installed wind power capacity reached 743 gig watts (GW) by the end of 2020, representing an increase of 53 GW from the previous year (GWEC, 2021) ^[2]. Wind power helps reduce dependence on fossil fuels and supports the transition to a greener energy mix.

Hydropower, derived from flowing water, is also a vital green energy technology. It involves using dams or turbines to capture the energy of moving water and convert it into electricity. According to the International Hydropower Association (IHA), hydropower represents the largest source of renewable energy globally, accounting for over 54% of total renewable energy capacity (IHA, 2021) ^[7]. Hydropower offers a reliable, renewable, and emission-free source of electricity.

Other green energy technologies making significant contributions include geothermal power and biomass energy. Geothermal power harnesses heat from the Earth's core to generate electricity. The Global Geothermal Alliance reported that global geothermal power capacity reached 14.9 GW by the end of 2020, with the potential to grow up to 40 GW by 2030. Biomass energy converts organic materials into biofuels or electricity.

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The International Renewable Energy Agency (IREA) stated that biomass contributed to approximately 7% of global renewable energy consumption in 2018 (IREA, 2019) [3].

Green energy technologies not only address environmental concerns, but they also fuel economic growth and promote energy security. According to the Renewable Energy and Jobs Annual Review 2020 by IREA, the renewable energy sector employed over 11 million people worldwide in 2019, with solar PV being the largest employer (IREA, 2020) [4]. Additionally, green energy technologies reduce dependence on fossil fuel imports and provide energy independence.

By harnessing these renewable resources and integrating cutting-edge technologies, the vision of an empowered future is within reach. This empowerment stems from the capacity to establish a cleaner, more sustainable energy landscape that not only meets the needs of current generations but also secures the well-being of those to come. Moreover, the transformative impact of green energy technology extends beyond environmental benefits, playing a crucial role in driving economic growth, fostering energy independence, and enhancing societal resilience (Smith *et al.*, 2019) [10].

Renewable Energy Sources

Renewable energy sources are sustainable and environmentally friendly alternatives to traditional sources of energy.

1. **Non-depletable:** Renewable energy sources, such as solar, wind, and hydroelectric power, are derived from naturally replenishing resources, making them non-depletable.
2. **Solar power:** Solar energy is harnessed from the sun using photovoltaic cells, and it is abundant, clean, and reliable, making it one of the most popular renewable energy sources.
3. **Wind power:** Wind energy is generated by harnessing the power of wind through wind turbines, providing a consistent and renewable source of electricity.
4. **Hydroelectric power:** Hydroelectric energy is produced by harnessing the power of flowing water to generate electricity, making it a reliable and renewable energy source.
5. **Biomass energy:** Biomass energy is derived from organic materials such as wood, agricultural residues, and waste, providing a sustainable energy source for heating and electricity generation.
6. **Geothermal energy:** Geothermal energy utilizes heat from the Earth's core to generate electricity and heat, offering a reliable and renewable energy source (IREA, 2021) [5].



Fig 1: Solar Power



Fig 2: Wind Power

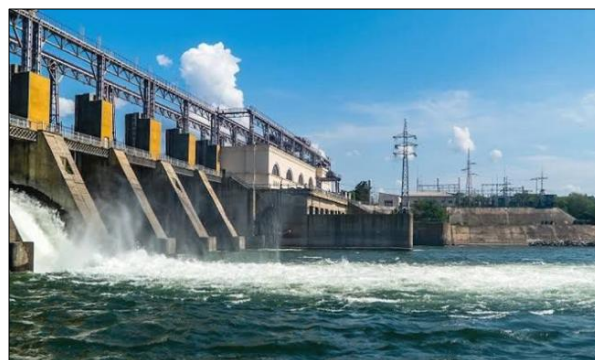


Fig 3: Hydroelectric Power

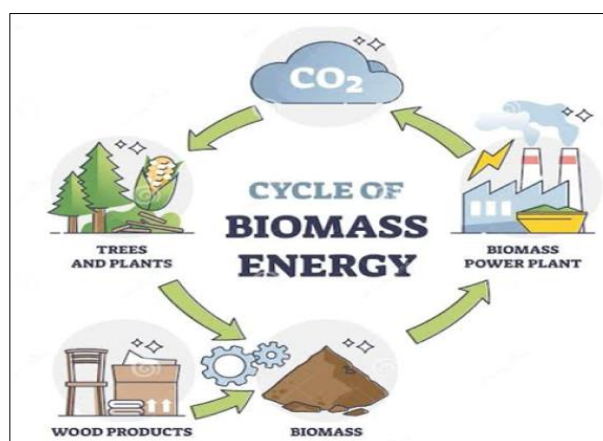


Fig 4: Biomass Energy



Fig 5: Geothermal Energy

Environmental impact and sustainability of green energy technology

1. **Reduced Greenhouse Gas Emissions:** Green energy technologies, such as solar, wind, hydroelectric, and geothermal power, produce lower levels of greenhouse gas emissions compared to traditional fossil fuels,

- thereby mitigating climate change and reducing air pollution.
2. **Promotion of Renewable Resources:** Green energy technologies promote the use of renewable resources, reducing reliance on non-renewable fossil fuels and contributing to long-term sustainability.
 3. **Economic Impact:** The construction and operation of renewable energy infrastructure create job opportunities, contributing to economic sustainability and growth.
 4. **Manufacturing and Disposal Impact:** It's important to consider the environmental impact of manufacturing and disposing of green energy technology components. Sustainable practices in manufacturing and recycling are crucial for minimizing environmental impact.
 5. **Land Use and Wildlife:** Renewable energy projects may require land use and can disrupt wildlife habitats. Sustainable planning and environmental impact assessments are necessary to minimize these effects.
 6. **Water Use in Hydroelectric Power:** While hydroelectric power is renewable, it may have implications for water use and aquatic ecosystems. Sustainable water management practices are important for the long-term sustainability of hydroelectric power.
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These points outline the environmental impact and sustainability factors associated with green energy technology (Jungbluth *et al.*, 2020) [8].

Conclusion

The advent of green energy technology represents a transformative leap towards a sustainable, resilient, and equitable future. By embracing renewable energy sources, minimizing environmental impact, and fostering economic opportunities and energy equity, we pave the way for a cleaner, more inclusive energy landscape. This shift not only mitigates the effects of climate change but also empowers communities, fosters innovation, and promotes long-term prosperity.

Solar power, wind energy, hydropower, geothermal power, and biomass energy have lower greenhouse gas emissions, reduced air pollution, and minimal resource depletion compared to fossil fuel-based energy generation. While some green energy technologies may have localized environmental impacts, continuous technological advancements and careful planning are mitigating those concerns. By adopting and expanding the use of green energy technologies, we can ensure a more sustainable and environmentally friendly energy future.

The future of green energy technology holds the promise of addressing environmental challenges, promoting sustainability, and driving economic growth. By harnessing renewable energy sources and adopting sustainable practices, we can reduce greenhouse gas emissions, minimize environmental impact, and create a more resilient energy infrastructure. As we continue to harness the potential of green energy technology, we embark on a journey to secure a brighter future for generations to come, where clean energy is not just a possibility, but a fundamental component of global progress and well-being.

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