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Scientific Exploration into the Promising Realm of Magnetic Energy: A Literature Review

Ragad M Tawafak, Saif AlShamsi, Ghalia Alfarsi, Abir AlSideiri

Information Technology Department, AlBuraimi University College,
Oman
**Corresponding Author*: raghad@buc.edu.om

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ABSTRACT: The use of permanent magnets, renowned for their self-sustaining magnetic properties, has been predominantly confined to small-scale generators. Conversely, electromagnets, composed of iron or steel cores cocooned within a web of wires, exhibit magnetization when subjected to an electrical current, consequently engendering a magnetic field. This intriguing aspect of magnets has kindled the scientific community's interest, particularly in the realm of electricity generation, where they have proven remarkably effective. As the world stands on the precipice of depleting finite oil reserves, the fundamental question looms large: What will serve as humanity's anchor when the last drop of oil is extracted from the Earth's depths? Could the advent of magnetic energy usher in a new era, redefining our reliance on conventional energy sources? These critical queries serve as the guiding compass for our scientific exploration into the promising realm of magnetic energy.

1. INTRODUCTION

In the grand tapestry of human civilization, the quest for energy is an enduring thread, interwoven with our pursuit of progress, scientific advancement, and the betterment of our lives [1]. Throughout history, we have harnessed various energy resources, including fossil fuels, nuclear power, and renewable energy, to propel our societies forward, driving the wheels of development and making our existence more comfortable and fulfilling [2]. However, in this relentless pursuit, we have unwittingly committed grave offenses against the natural world, failing to recognize or heed the warning signs of impending ecological crises. Now, nature's voice is calling out, beseeching us to acknowledge its plight and rectify our missteps, for the Earth is not merely a resource but our home, without which our existence would be rendered impossible [3].

The ominous ramifications of global warming arise from the release of greenhouse gases, most notably carbon dioxide (CO_2), which blankets the Earth's atmosphere, trapping heat and preventing thermal radiation from escaping into space [4]. This insidious process culminates in a surge in global temperatures, amplifying desertification and drought, and irrevocably altering the world as we know it [5].

In this context, the research community has not remained idle. Scholars have tirelessly explored the intricate web of energy transition, sustainability, and resource allocation in the face of depleting oil reserves and escalating energy prices [6]. They have delved into the potential of renewable energy sources, magnetic fields, and innovative technologies, aiming to carve a path toward a future untethered from fossil fuel dependence [7].

In this research undertaking, we pledge to explore these thought-provoking questions with fervor and precision [8]. Armed with the arsenal of knowledge amassed by scholars who have traversed similar intellectual landscapes, we set out to illuminate the potential of magnetic energy as a catalyst for a more sustainable and environmentally responsible future for humanity. We harbor the firm belief that scientific inquiry, with its unique capacity to unveil novel solutions, stands as the beacon guiding us through the formidable challenges that loom large on the horizon [9].

2. LITERATURE REVIEW

The research paper, titled "The Green Age," delves into the potential of magnetic energy as a transformative force in addressing humanity's pressing energy sustainability challenges and mitigating environmental degradation [10]. The study undertakes a comprehensive examination of the history of energy sources, their environmental consequences, and the transition to cleaner alternatives. It also explores the principles of Faraday's law and the Lorentz force and their role in current and potential future innovations [3].

3. ENVIRONMENT

We all know that one of the biggest causes of global warming is the burning of fossil fuels and deforestation due to the increase in population in short (human activity). environment greatly [8]. In order to produce energy, coal, natural gas, and oil are referred to as "fossil fuels." This energy is used to produce electricity, as well as to power industrial activities, as well as transportation (such as cars and airplanes) [4]. We have been steadily burning more fossil fuels ever since the first coal-fired steam engines were developed in the 1700s. We currently use more fossil fuels globally each year than we did in 1776, which is more than 4,000 times [9]. Fossil fuel combustion has a significant impact on our climate and ecosystems, particularly when it comes to carbon dioxide emissions. The main factor generating the current climate change, which is affecting the Earth's ecosystems and leading to issues with human and environmental health, is the burning of fossil fuels [11].

Facts about air pollution, the truth about air pollution In light of the fact that nine out of ten people on the earth now breathe contaminated air, the United Nations issued a warning on World Environment Day that no one is immune to air pollution [10]. The World Health Organization (WHO) estimates that this has caused an expanding worldwide health catastrophe, which already accounts for nearly 7 million annual deaths. Fossil fuel combustion is the primary source of carbon emissions that contribute to global warming and air pollution, and addressing both issues at once could have a significant positive impact on public health [11]. Fossil fuel combustion is a major contributor to air pollution as well as the main source of these emissions [11]. Figure 1 below shows the air population for healthcare.

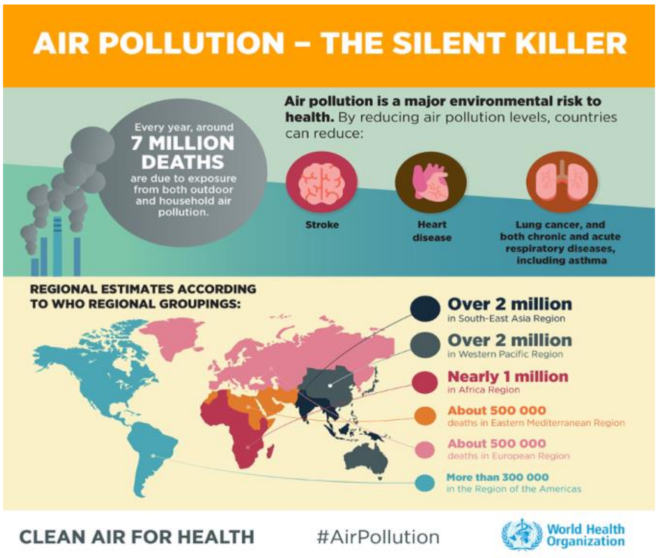


Figure 1: UN Environment, World Health Organization, World Bank, Every Breath Matters campaign

4. POWER PLANTS FROM MAGNETIC FIELDS

My goal is to find a way to produce electric energy from magnetic fields, but it's not possible to generate electricity directly from magnetic fields alone. However, magnetic fields can be used in power plants to generate electricity through the process of electromagnetic induction [1]. This is the principle behind electric generators, which use mechanical energy to turn a coil of wire in a magnetic field, inducing an electric current in the wire [3]. In power plants, this mechanical energy is typically provided by a turbine that is turned by steam produced by burning coal, natural gas, or other fuels, or by using the energy of falling water in a hydroelectric power plant [7]. The generator then converts the mechanical energy into electrical energy, which can be transmitted to homes and businesses for use. While the magnetic field is a crucial part of the process, it is not the source of the energy itself, but rather the means by which the mechanical energy is converted into electrical energy [4].

Projects that are expected from this research, Envisioning the outcomes of this research sparks a cascade of transformative projects, poised to redefine our relationship with energy. Picture a future where cars seamlessly navigate, perpetually powered by magnetic energy, eliminating the need for charging or petrol. Imagine houses suspended with magnetic energy, resilient against earthquakes, offering a novel approach to sustainable architecture. Visualize apartments floating atop each other through magnetic forces, addressing the challenge of population growth without sacrificing forests. Envision a world where all lights operate on self-generated magnetic energy, contributing to a surplus of electricity, thereby catalyzing a global economic upswing, also new power source from Magnetic Fields: MagnoEnergizer an alternative to oil, gas, and other traditional sources. This research, grounded in the principles of Faraday's law and the dynamics of magnetic fields with conductor materials, charts a course toward a future where magnetic energy becomes the cornerstone of a sustainable and vibrant world.

Challenge's, it's not possible to generate electricity directly from magnetic fields alone, as the generation of electricity requires a relative motion between a magnetic field and a conductor [5]. However, if we assume that a magnetic field is already present and a conductor is in motion, some challenges to generating electricity include the efficiency of converting the mechanical energy to electrical energy, the durability of the system over time, and the potential safety hazards associated with high voltages and currents [8]. With Faraday law and Lorentz force, perhaps we will come to a point where we can make the impossible possible.

Faraday law, Faraday's law of electromagnetic induction states that a changing magnetic field induces an electric current in a conductor [9]. It is a fundamental principle in physics and is the basis for many modern technologies, including electric generators, transformers, and electric motors. The law is named after the English scientist Michael Faraday, who first described the phenomenon in the early 19th century. Mathematically, the law is expressed as an equation that relates the magnitude of the induced electromotive force (emf) to the rate of change of the magnetic field. The law is often summarized as "a changing magnetic field induces an electric field" [14].

Lorentz force, The Lorentz force is the force experienced by a charged particle when it moves through an electromagnetic field [6]. It is named after the Dutch physicist Hendrik Lorentz, who first described the phenomenon in the late 19th century. The force is perpendicular both to the velocity of the charged particle and to the magnetic field and is proportional to the magnitude of the charge and the strength of the magnetic field [3]. The Lorentz force is an essential concept in physics. It is used to explain many phenomena, including the behaviour of charged particles in electric and magnetic fields, the operation of electric motors and generators, and the interaction between charged particles in particle accelerators [11]. The equation for the Lorentz force is

$$\boldsymbol{F} = \boldsymbol{q}(\boldsymbol{E} + \boldsymbol{v}\,\boldsymbol{x}\,\boldsymbol{B})$$

where **F** is the force, **q** is the charge of the particle, **E** is the electric field, **v** is the particle's velocity, and **B** is the magnetic field [15].

Electromagnetic Induction

Electromagnetic induction is the process by which a changing magnetic field induces an electromotive force (EMF) or voltage in a coil or conductor. This phenomenon is fundamental to the functioning of many electrical devices.

Faraday's Law of Electromagnetic Induction

Faraday's law states that the magnitude of the induced EMF is directly proportional to the rate of change of the magnetic field with respect to time. Mathematically, it is expressed as

$$EMF = -N\frac{d\varphi}{dt},$$

where EMF is the induced electromotive force, N is the number of turns in the coil, and $\frac{d\varphi}{dt}$ is the rate of change of magnetic flux.

Example:

Imagine a coil with 100 turns. If the magnetic flux through the coil changes at a rate of 0.5 Weber per second, according to Faraday's law, the induced EMF would be:

$$EMF = -100\,x\,0.5 = -50\,Volts$$

The negative sign indicates the direction of the induced current according to Lenz's law.

In summary, electromagnetic induction is a process where changing magnetic fields induce an EMF in a coil, and Faraday's law quantifies this relationship.

The calculated induced electromotive force (EMF) of -50 Volts in the example signifies the potential difference generated in the coil due to a changing magnetic field. Let's explore an application and compare it with other energy sources:

Example: Electric Generator

Consider the use of the coil in an electric generator. When a coil with 100 turns is exposed to a changing magnetic field, an induced EMF of -50 Volts is generated. This negative voltage implies a direction of current flow, following Lenz's law.

In an electric generator, this induced EMF can be harnessed to produce electrical power. The generator consists of coils rotating in a magnetic field. As the coils rotate, the magnetic field they experience changes, leading to the generation of an EMF. This induced voltage can then drive an electric current in a closed circuit, providing a source of electrical energy.

Let's imagine the street lights as the performers on a stage, creating a well-lit scene for the night. In the world of electricity, these lights have their own backstage crew, and one key player is electromagnetic induction.

Usually, the electricity for these lights comes from the grid or independent systems. Think of these systems as the powerhouses working behind the scenes. Now, if this electricity is born in a power plant with generators, here's where the real magic happens.

Picture the generators as the magicians of the power world. They use electromagnetic induction, a kind of enchantment, to transform mechanical energy into electrical energy. It's like turning the motion of a dance into the sparkle of fairy lights. The changing magnetic field inside these generators does the trick, creating an electromotive force (EMF) that brings the electrical energy to life.

So, while electromagnetic induction may not take the spotlight in directly powering street lights, it's the unsung hero in the grand production, making sure the lights shine bright. in my research, I'm on a quest to find a sustainable way for magnets to take center stage, generating power independently, without relying on other sources. It's like giving the backstage crew their own spotlight moment in the electrifying performance of energy generation!

Creating power generators from magnetic fields involves harnessing the principles of electromagnetic induction. If we want to develop such generators, we must take these basic steps that I would like to explore:

- Understanding magnetic fields
- Design file
- Magnetic field sources
- Improvement factors
- Energy storage
- Safety Considerations
- Prototyping and testing
- Iterative development
- Expansion considerations
- Regulatory Compliance

Innovation often involves a combination of theoretical knowledge, experimentation, and a desire to learn from successes and challenges.

Comparison with Other Energy Sources:

Fossil Fuels (e.g., Coal, Natural Gas, Oil):

The MagnoEnergizer, as a source of electric power, presents a cleaner and more sustainable alternative compared to traditional fossil fuels. Fossil fuel combustion contributes to environmental pollution and is a finite resource, whereas MagnoEnergizers rely on the interaction of magnetic fields without the need for fuel consumption.

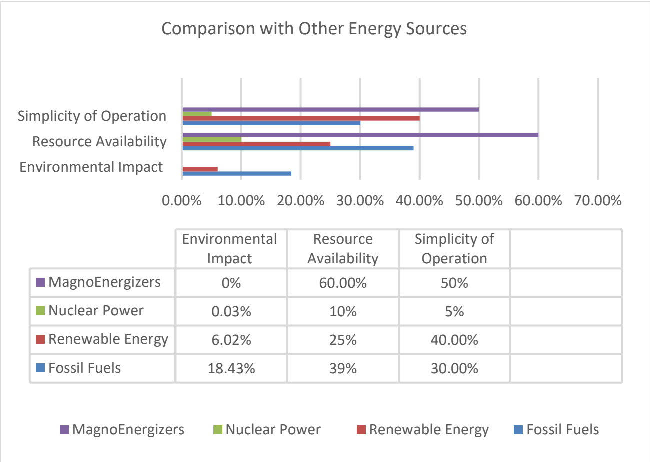
Renewable Energy (e.g., Solar, Wind):

In comparison to renewable energy sources like solar and wind, MagnoEnergizers share the advantage of being environmentally friendly. However, solar and wind energy sources depend on natural conditions (sunlight, wind), whereas MagnoEnergizers can offer more consistent and controllable energy generation.

Nuclear Power:

MagnoEnergizers, in the context of electric generators, are less complex and do not involve the potential risks associated with nuclear power generation. Nuclear power relies on fission reactions, which have safety and waste disposal challenges.

In summary, MagnoEnergizers provide a sustainable and versatile method for generating electrical energy. When compared to traditional and other renewable energy sources, they offer advantages in terms of environmental impact and simplicity of operation.



	Environmental Impact	Resource Availability	Simplicity of Operation
MagnoEnergizers	0%	60.00%	50%
Nuclear Power	0.03%	10%	5%
Renewable Energy	6.02%	25%	40.00%
Fossil Fuels	18.43%	39%	30.00%

Figure 2: Hannah Ritchie (2020) - "What are the safest and cleanest sources of energy – journal: Our World in Data Note: The MagnoEnergizers source is not true data, it's expected for the research.

The bar chart presents a comparison of various energy sources, including Fossil Fuels, Renewable Energy, Nuclear Power, and the innovative MagnoEnergizers. The three key metrics considered are environmental impact, simplicity of operation, and resource availability. Each energy source is evaluated on a scale, providing a visual representation of its comparative strengths and weaknesses in these crucial aspects. MagnoEnergizers, as a novel energy source, make their debut in this comparison, inviting scrutiny alongside conventional and alternative options. This chart serves as a valuable tool for decision-makers and researchers, offering insights into the potential environmental benefits, operational ease, and resource accessibility of different energy choices.

5. THE FUTURE OF HUMANITY WITH CLEAN ENERGY

The section on the future of humanity with clean energy paints a hopeful picture of how transitioning to cleaner energy sources can address major environmental and social challenges [7]. The discussion of hydrogen fuel cells as a promising energy source aligns with the research's exploration of innovative technologies, highlighting the potential of magnetic energy alongside other sustainable alternatives [8].

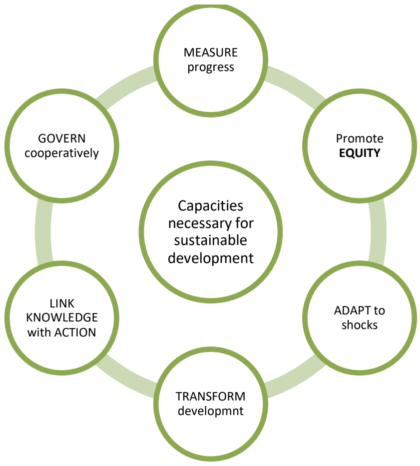


Figure 3: Capacities necessary for sustainable development

Power Plants from Magnetic Fields

This section clarifies that while electricity cannot be generated directly from magnetic fields, magnetic fields play a vital role in power plants through electromagnetic induction. It effectively sets the stage for the subsequent discussion of the challenges and benefits of harnessing electromagnetic forces in power generation [6]. The discussion of challenges and potential innovations related to Faraday's law and the Lorentz force is a critical component of the paper [1]. It highlights the complexities involved in utilizing magnetic energy and showcases the potential for innovation in various fields, such as electrical power generation, renewable energy, wireless power transfer, transportation, particle accelerators, fusion research, electromagnetic propulsion, and nanotechnology. This section underscores the versatility and importance of these fundamental principles in driving technological advancements [16].

Key Factors Influencing Electromagnetic Electricity Generation Effectiveness

The effectiveness of electromagnetic electricity generation relies on several pivotal factors, each playing a critical role in determining the efficiency and feasibility of this innovative energy conversion process [10]. Understanding these key factors is essential for optimizing magnetic energy conversion systems and realizing their full potential in sustainable electricity generation. Among these influential factors are:

1. Magnetic Field Strength:

- The strength and intensity of the magnetic field within the electromagnetic generator are fundamental factors. A stronger magnetic field typically induces a higher electromotive force (emf) in the conductor, following Faraday's law of electromagnetic induction.

Consequently, a robust magnetic field enhances the potential for efficient electricity generation.

Figure 4: Sustainability Development Stages

2. Conductor Materials:

- The choice of conductor materials profoundly impacts the effectiveness of electromagnetic electricity generation. Conductive materials with higher electrical conductivity and lower resistivity are more conducive to efficient energy conversion. The selection of materials affects both the induced EMF and the overall system efficiency [16].

3. Speed of Relative Motion:

- The relative motion between the magnetic field and the conductor is a pivotal factor in determining the rate of change of the magnetic flux, as described by Faraday's law. A higher speed of relative motion results in a more rapid fluctuation of the magnetic field, leading to increased EMF induction [17]. Controlling and optimizing this motion is essential for maximizing electricity generation efficiency. We need to undertake this task to test our idea and assess its viability. The electromagnetic generator involves dynamic interactions of various factors, and it is imperative that we carefully examine them for the purpose of system design and optimization [18]. To attain the desired level of electricity generation efficiency and unlock the complete potential of magnetic energy conversion, it is essential to strike a balance between magnetic field strength, conductor materials, and relative motion speed.

Moreover, achieving success in this endeavor requires fostering interdisciplinary collaboration, conducting rigorous experimental investigations, and maintaining a constant focus on improvement [17]. Researchers and engineers engaged in this field must continually refine and innovate these influential factors, ultimately paving the way for a sustainable and environmentally responsible future driven by magnetic energy.

6. DISCUSSION

The pursuit of harnessing electromagnetic principles for electricity generation offers a tantalizing glimpse into the future of sustainable energy production. However, as with any transformative technological endeavor, there are significant challenges that must be thoughtfully considered and effectively addressed. In the context of this research, several critical factors merit discussion:

Magnetic Field Strength: The strength of the magnetic field within the electromagnetic generator is pivotal for its effectiveness [17]. A robust magnetic field induces a higher electromotive force (emf) in the conductor, aligning with Faraday's law of electromagnetic induction. Maximizing magnetic field strength is an ongoing challenge, necessitating advancements in magnet technology and materials to generate more powerful and efficient magnetic fields [15].

Conductor Materials: The choice of conductor materials is another fundamental aspect that affects electromagnetic electricity generation. Materials with high electrical conductivity and low resistivity are preferred to minimize energy loss and enhance efficiency. Research in this area revolves around developing new materials or refining existing ones to achieve better conductivity and reduce electrical losses [18].

Speed of Relative Motion: The speed at which the magnetic field and conductor interact significantly impacts the rate of change of the magnetic flux, which, in turn, affects electricity generation efficiency. Achieving the optimal relative motion speed is a complex task. Research and engineering efforts are continually focused on designing systems that can efficiently control and optimize this motion [19].

These factors are interconnected, and achieving a balance among them is crucial for successful magnetic energy conversion. Researchers and engineers must work collaboratively, drawing from multiple disciplines, to address these challenges comprehensively [5].

Interdisciplinary collaboration is a cornerstone of progress in this field. Experts from physics, materials science, engineering, and other related disciplines need to work together to refine the understanding of these factors and develop innovative solutions. Additionally, the combination of rigorous experimental investigations and iterative improvement is vital. Continuous testing and refinement of systems are necessary to push the boundaries of electromagnetic electricity generation [16].

In conclusion, the successful realization of sustainable and environmentally responsible electricity generation through magnetic energy conversion relies on a deep understanding and optimization of the key factors discussed. Through ongoing research and interdisciplinary cooperation, we can move closer to unlocking the full potential of this promising technology and pave the way for a cleaner and more sustainable energy future [15].

7. CONCLUSION

In conclusion, our world stands at a critical juncture where the imperative shift toward green energy sources and the depletion of natural resources converges with the pressing need to combat environmental degradation and global warming. Our path forward must embody both technological ingenuity and environmental responsibility. To address these challenges, we must embrace renewable and clean energy sources like solar power, wind power, hydropower, geothermal energy, and biomass energy, reducing our reliance on environmentally harmful fossil fuels. This transition requires united efforts from governments, businesses, and individuals, encompassing investments in clean energy technology, energy efficiency promotion, and waste reduction. Furthermore, we should explore innovative approaches, including the potential of harnessing magnetic principles for electricity generation, as a promising alternative to fossil fuels. By making these choices, we safeguard the well-being of our planet and secure a brighter, more sustainable future for generations to come. It falls upon us to shape this future, where humanity thrives in harmony with Earth's natural systems.

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