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A Review on Nuclear Energy

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ABSTRACT
Sustainability is described as an environmental strategy that is ideally suited for eco-systems and capable of successfully and continuously managing a cycle. In every aspect, the key to the humanity race's long-term survival is sustainability. Due to recent resource depletion and worries about climate change, many people are considering the benefits and dangers of nuclear energy as a viable option. Nuclear energy's advantages, such as no greenhouse gas emissions and a large amount of low-cost electricity, are severely restricted by the risk of fatal accidents and the long-term disposal of radioactive waste. This article highlights the advantages and dangers of nuclear power for a sustainable energy demand since nuclear power is a matter of balancing gain and risk. Robotic systems are an excellent solution to some of these issues since they remove the need for humans to visit these places while also providing data on their health that would otherwise be inaccessible. However, each robot's requirements are sometimes very different, or even the most robust platforms may encounter considerable challenges owing to the unique characteristics of a particularly challenging environment. However, such improvements may be both costly and time-consuming to implement. Sustainability are all words that come to mind while thinking about climate change. Sustainability are all words that come to mind while thinking about climate change.

Keywords
Climate Change, Energy Intensity, Effects, Nuclear Energy, Radioactivity.

1. INTRODUCTION
The modern era is low on resources, and it will most likely collapse in the next days. Nearly one billion people (or 22% of the global population) do not have access to electricity. For examples, 2.6 billion people (42 percent of the world population) rely on traditional biomass for basic energy requirements such as cooking and heating. Diversification of energy sources would be required to decrease GHG emissions while guaranteeing that the bottom 2 billion people – those living on much less than 2.6 US dollars per day – had access to modern energy services. Because of the interrelated issues of natural resource preservation, energy shortage, and climate change, the UN Energy and Climate Change Advisory Group's (AGECC) goal in April 2011 is a difficult job. By 2031, the goal is to create a global answer to modern energy. Currently, many countries think nuclear power is the greatest choice. However, incorporating nuclear technology into a country's energy infrastructure is not without challenges. It has a good chance of producing adequate energy and having a low environmental effect, but there are concerns about its long-term viability. Nuclear power is also regarded as a solutions to climate change, since energy generated in large numbers by the burning coal, oil, including natural gas must be complemented by alternatives that have a lower environmental effect. Alternative energy such as solar, wind, hydro, and waves will need to be substantially expanded in order to replace the fossil fuels now utilized. This would be critical in order to improve energy efficiency on a broad scale, as outlined in the EU energy objectives, for example, where efficiency improvements are not limited to electricity. Hybrid and alternative fuel vehicle production is an offshoot that raises the need for renewable energy[1].Atomic energy may be utilized as a carbon-neutral source, obviating the need for fossil fuels in the manufacturing, construction, and maintenance of nuclear power plants, as well as the disposal of nuclear waste. However, radioactive energy cannot be regarded a dependable source of power because, apart from the risk of nuclear radioactivity from accidents and difficulties at mining sites, it is a finite resource. It was attempted to identify not only the environmental impacts of nuclearpower based on emissions, but also the effects of ionizing radioactive waste radiation. Despite the fact that a major nuclear catastrophe would inflict long-term harm to humans and other creatures, the overall assessed effect is modest since such incidents are thankfully rare (whether estimated or dependent on statistical exposure to radiation). How the total energy supply is linked to the ultimate energy consumption is determined by the primary energy factor. The main energy factor is used to compare the resource efficiency of various fuels or energy sources while ignoring additional effects on the environment, such as pollution and the risk of biological extinction. The primary energy estimations have certain flaws (for example, resource limitations are not adjusted); nevertheless, the study focuses on a precise main nuclear energy component. The argument is that existing major factors in nuclear power do not account for all energy losses. In reality, the Nuclear Fuel Cycle Open does notinclude the annihilation of fuel or hazardous waste (NFC). Given the predominance of nuclear technology in the industrial world's energy systems, the effect on the real value of PEF would be enormous, even affecting the weighted average PEF for individual nations as well as regions such as the EU. This study examines the current estimate of the main nuclear power factor and suggests a new, more accurate nuclear power PEF measurement[2].

1.1 Development that is Sustainable
People are seen to be at the heart of problems of sustainable development. They have the right to a secure and prosperous existence in line with nature. States have the freedom to use their resources and the responsibility, under international law, to ensure that any activities under our jurisdiction do not harm the environment or any other country. The right to growth, on the other hand, must be protected in order to fulfill the environmental and economic requirements of current and future generations equitably. Poverty eradication is seen as a critical component of long-term development. Climate change poses a major threat to the long-term viability of life on Earth [4]. This is a very complicated and unpredictable issue that

represents the dynamic interplay of organizational growth, government administration and regulation, natural factors, and individual behavior[3].

Sustainable development is generally seen to require the following commitments:

- Food and safety are both important factors.
- Construction of infrastructure such as schools, plantations, and transportation.
- Adequate quantities of water are available.
- Disease prevention and medical diagnostics

1.2 Effects of Global Climate Change

In recent years, dramatic weather shifts across the globe have resulted in massive climate change. The greenhouse effect issue has received a lot of attention and is being addressed seriously by governments all around the globe. Global warming is caused by the greenhouse effect, which is a serious problem that cannot be overlooked. According to research and literature, the quantity of carbon dioxide (CO2) in the atmosphere has increased by 28% during the industrial revolution. The average global temperature has increased by 0.2 percent to 0.4 percent each year, while the sea level has risen by 12 to 16 cm in the past 100 years. If greenhouse gas emissions continue at their present rate, global average temperature is expected to rise by approximately 1 degree Celsius in 2024 and 4 degrees Celsius by the end of the century. Human activities are mainly to blame for the increase in atmospheric GHG concentrations. Scientists predict that if no effective environmental protection measures are implemented, the global temperature would increase by one to three and a half millimeters, and the sea level will rise by 15 to 95 centimeters. Many countries will be uninhabitable by 2100. According to the second assessment report of the Intergovernmental Panel on Climate Change (IPCC), atmospheric CO concentrations rose from 281 to 358 ppm in 1994. The World Meteorological Organization (WMO) discovered that CO2 concentrations reached 383 parts per million in its 2007 Greenhouse Gas Annual Report. CO2 is the most common greenhouse gas produced by different sources, with the energy sector alone accounting for 32% of global CO2 emissions[4].

1.3 A New Source of Energy: Nuclear Energy

The star, of which our sun is one, depends on nuclear fusion for its fire, light, and other radiations. If one believes in the Big Bang hypothesis, the Planet may likewise be viewed as a component of the Sun. The fusion reaction is exactly what happens on the Sun. Fission-reaction energy is generated from the fuel that was initially created from a nuclear reaction with uranium or plutonium in the sun. Nuclear reactors, whether slow thermal with moderators or rapid breeders with refined fuels, may provide a contemporary, environmentally friendly fuel type [8]. Between 2006 and 2030, global demand for primary energy is projected to rise by 46%, a 1.7 percent annual average growth rate less than the 1.8 percent annual growth rate seen from 1980 to 2007. The International Atomic Energy Agency (IAEA), the world's leading source of nuclear intelligence, projected in August 2009 that global nuclear capacity will double by 2030, from 373 giga watts (GWe) to 807 GWe, making it the most significant international information source on nuclear power[5].India has slightly over 300 gigawatts (GW) of installed power as of May 2015. (Utility). Thermal energy accounted for 211GW (70%) of these, which included coal, gas, and diesel. India depends largely on fossil fuels to fulfill its energy requirements. Hydro power accounts for a significant portion of the gross installed capacity, which is little over 42 GW. The network, which comprises of wind, solar, biomass, and small hydraulic fuel, has a total capacity of less than 42 GW. Nuclear energy has an installed capacity of 5,34 GW, which is just 1.8% of total capacity. In terms of new energy production, India generated 1,248 terawatt hours of total power in 2014-15. Only the United States, Russia, and China are energy-poor, despite India being the world's fourth biggest energy user. The network, which comprises of wind, solar, biomass, and small hydraulic fuel, has a total capacity of less than 42 GW. Nuclear energy has an installed capacity of 5,34 GW, which is just 1.8% of total capacity. In terms of new energy production, India generated 1,248 terawatt hours of total power in 2014-15.(TWh). Only the United States, Russia, and China are energy-poor despite India being the world's fourth biggest energy user. China's per capita energy consumption is about 4,000 kWh. In 2014, about 237 million people in India lacked access to electricity, accounting for roughly 19% of the country's entire population. India's total carbon emissions are projected to rise by 2,3 million tones in 2015, a 7.6% increase over 2013. India's GHG emissions have risen by almost 200 percent since 1990. India commits to increasing carbon intensity to 40% of total production, including renewable energy capacity, in its NDC. Nuclear power, which has a lot of potential, should be a big component of the country's future energy mix.

1.4 The Issue of Nuclear Energy Problems

Processing and management of high-level hazardous radioactive waste, potential proliferation and terrorist applications, high building costs, and probable accidents are all disadvantages of nuclear power. Another issue that might be considered a nuclear energy hurdle is widespread public awareness. The following is a list of the disadvantages discovered.

1.5 Waste that is Radioactive

High-level radioactive waste is very hazardous. It may continue for tens of kilometers before returning to normal levels. It's highly radioactive, and it's a major impediment to nuclear proliferation.For more than 50 years, the earth has been burdened with a legacy of hundreds or thousands of tons of extremely hazardous garbage that will endure hundreds of thousands of years. On average, plutonium ore contains just 0.2 percent plutonium. The majority of nuclear reactors need a particular kind of uranium-235 (U-235). Only 0.6 percent of natural uranium is in this form. To enhance the concentration of U-235, uranium recovered from ore is enriched using limited amounts of accessible nuclear or vast volumes of waste. If the output of nuclear power increases substantially in the next decades, so will the need for waste disposal that is both safe and sustainable. Elevated nuclear waste has a thousand-year lifespan before returning to health, therefore it must be addressed before it spreads. Radioactivity may be fatal to the human body.

1.6 Proliferation

Some nuclear reactors, referred to as 'breeder' reactors, produce plutonium, which may be used to build nuclear bombs. This is a conventional explosive mixed with radioactive materials in order to spread the explosives over a large region and cause much more harm. Because contemporary global politics aims to acquire more influence or share the resources of any competitor country, any nuclear power project may turn into a nuclear weapons program at any moment.

1.7 Fuel Availability

Nuclear power is much less natural than fossil fuels from a physical standpoint. Fossil fuel is generated on Earth, at least

in part, over millions of years. Heavy metals like uranium are present even after stars die in supernovas. In fact, our solar system arose from the ashes of another star, which slowed the evolution of the elements. They aren't really gone until they are completely gone. Particle accelerators are the sole way to make heavier elements. As a result, the kind of fuel required for the nuclear program is inadequate.

1.8 Nuclear Power: A Long-Term Solution

Nuclear power is safe and has the potential to provide the world with fuel forever without losing the energy that is so badly required for other purposes. Nonetheless, the consequences of nuclear power production have remained unclear to date. The assessment of damage is further confounded by the fact that it is conceivable that it may occur decades later. The advantages of nuclear energy in terms of reducing its dangers are similarly difficult to quantify. Nuclear power seems to be a viable option. When the true cost of carbon is considered, however, it is also more damaging than fossil fuels. Nuclear energy, for example, takes a long time to produce. The process of preparing for assessments of nuclear power plant environmental impacts, as well as the time between planning and execution, often takes many decades. Further radioactive waste, which also requires a huge subterranean facility, seems to be more contentious than pollution from fossil fuels. Given these apparent obstacles, the sector may be the most vulnerable to catastrophic accidents and radioactive spread. Because the damage produced by such an event is difficult to handle in terms of immediately providing safety or care by dispatching an emergency rescue team, the terrible consequences of this kind of injury may be passed down through generations through radiation, causing eternal suffering for humanity[6]The majority of scientific publications treat primary nuclear energy not just as a variable in equations or experiments, but also as a numerical value. In scientific publications, there are just a few references to this subject. Specific energy measures for different power generating technologies are discussed in a Power Policy study. Primary energy demand is one of these measures, often known as cumulative energy demand (CED). The writers discuss the main energy sources of nuclear, hydro, and wind power. There are two nuclear energy proposals that are now being discussed. The total energy of the nuclear reactor is categorized as main energy content, with a 3 percent increase in final (electric) power or a 33 percent increase in energy output throughout the life cycle. The second method is extensively utilized in the Eco Invent database for life cycle assessments. Energy content refers to the main energy of a fissile isotope produced from actual uranium mines. The second approach implies that the whole life cycle is more systematic, and that large authoring gaps should be avoided. An example of GEMIS-based concepts may be found at the IINAS (International Institute for Sustainability Analysis and Strategy). The second approach is based on a broad perspective. GEMIS is a statistical model for lifetime measurement that is used in both EU and OECD nations. It "calculates the environmental consequences of electricity, products, and transportation, such as air pollution, greenhouse gas emissions, waste, and capital" (primary resources, raw material and land, water). The model considers both the direct and indirect effects of auxiliary materials and resources utilized in the process creation[7].According to a study by Adapt Consulting for Energies Norway, different variables for power conversion will be presented, as well as an effect assessment for EU energy and environmental goals. The research examines the link between nuclear and renewable energy sources and PEFs, concluding that "the energy efficiency of air and sun as a fuel cannot be measured for wind and solar plants." Only 10% of the potential energy content of nuclear fuel is converted into electricity in conventional nuclear power plants, although substantial portions of the energy content may be reprocessed. The issue is with the "partial replacement technique," which is based on the predicted energy quality of conventional fossil fuels. In other words, biomass and nuclear energy are the primary sources of fossil energy (42 percent efficiency overall).According to experts, natural resources may be identified as:

- Renewable or nonrenewable resources;
- Assets, inventories, or flows;
- Biotic or biotic (the result of previous biological (e.g., crude petroleum) and chemical (e.g., metal) activities).

LCA (Life Cycle Assessment) analyzes the environmental impacts of material and energy flows based on inflows into the technical framework (resource usage) and outflows (emissions to air, water, and land). The shortage of resources in LCA may be considered at many levels, including RAM, midway depletion, and endpoint depletion. The PEF (CED) computation will get a RAM rating [3]. A variety of techniques are identified and addressed to assess resources utilizing energy methods, etc., and are often used in the case of ethylene. Although some of these techniques may be more rigorous and insightful than PEF, PEF and CEDs are now so widely used that it would be more essential to suggest a modification in the PEF measurement than to suggest new measures. In order to return to the concept of basic energy, all pre-combustion losses must be included

2. LITERATURE REVIEW

Mazen M. Abu-Khader et al studied about the increasing focus to nuclear power as a potential energy source for electricity production has been fueled by the rise in oil costs and greater concern about environmental protection from CO2 emissions. This study examines current advancements in the area of nuclear power as well as elements of nuclear power. Economics, security, nuclear reactor architecture, spent fuel processing, or waste management are just a few of the topics covered[8]. Siddharth Suman et al. studied about Climate change or energy security are two of the most pressing concerns of the twenty-first century. Renewable energy sources are intermittent, dependent on geographic location and climatic conditions, as well as require a significant amount of land. Since of public apprehensions but instead subsequent government policies, the future of nuclear energy is also uncertain. A new hybrid or incorporated nuclear-renewable energy systems is being proposed or seen as an attractive proposition to overcome the issues that are derailing these two virtually carbon-free energy sources. Such integrated energy systems are envisioned as a nuclear power reactor combined with renewable energy generation as well as industrial processes that can address climate change, grid flexibility, energy security, optimum solution return on capital employed, as well as resolving public concerns all at the same time. The current paper delineates the different aspects associated with integrated nuclear renewable energy systems, in addition to highlighting the key difficulties associated with nuclear energy and renewable energies while operating as a self-sufficient power generation system. It's possible that combining nuclear and renewable energy into a single hybrid energy system, linked through informatics, would allow them to overcome the drawbacks that exist when they operate

separately[9].S. yalcin et al. studied about the generation of hydrogen from water using thermochemical techniques may be the most suitable use for the high temperature reactor. Because of their availability and ease of use, fluid fossil fuels now meet a significant part of the world's energy needs. However, the long-term effects are limited. The scarcity of petroleum or natural gas supplies, as well as their high cost, are becoming more apparent. Because of this, new types of energy are needed to address the world's future energy market challenges, particularly in terms of climate change. Fossil fuels are being phased out. This article demonstrates how nuclear energy may make a significant impact to global warming[10].

4. DISCUSSION

Sustainability is considered as an external strategy that is well-suited to eco-systems and capable of managing a cycle effectively and constantly. Sustainability is the cornerstone to the humankind race's long-term existence in every way. Many people are contemplating the advantages and risks of nuclear energy as a feasible alternative due to current resource depletion and concerns about climate change. The benefits of nuclear energy, including no greenhouse gas emissions and a huge quantity of cheap power, are severely limited by the danger of deadly accidents as well as the long-term disposal of radioactive waste. On the other side, energy security is a subject that necessitates the development of an energy plan to handle supply security, environmental effects, national competitiveness, including social issues. Nuclear energy may be able to satisfy rising global energy demand, but it is difficult to admit it as a viable energy option when security and safety issues are taken into account. However, it is impossible to predict whether nuclear power would be the only option in the future. In order to enhance their appropriateness for the future, ongoing research or development efforts in this area should be conducted, and alternative solutions should be investigated to evaluate their viability for fulfilling renewable energy demand.

5. CONCLUSION

The study concludes one of the major issues addressed in this article, which will impact energy security now and in the near future. From an impartial standpoint, the facts elevate their future effects. In the long run, the current trend of switching energy sources from traditional fossil fuels to nuclear power is attractive to nations since it reduces global warming, climate change, and enhances resource protection. Energy security, on the other hand, is a topic that requires an energy strategy to address: supply security, environmental impacts, national competitiveness, and social problems. Nuclear energy may definitely meet increasing global energy demand, but when security and safety concerns are considered, it is difficult to accept it as a viable energy alternative. However, it cannot be assumed if nuclear power would be the sole alternative in the future. Continuing research and development initiatives in this area should be undertaken in order to improve their suitability for the future, and alternative solutions should be examined to determine their feasibility for meeting renewable energy demand.

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