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Constraints of Renewable Energy Technologies: An Editorial Review

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Abstract: *Every year, advancements in renewable energy technology make it more practical, affordable, and accessible. Still, only 20% of our global energy consumption comes from renewables. Some other examples of renewable energy are hydropower, geothermal energy, biomass, and the sun and the wind. The only thing to do is tap into these resources and it will be set. There has been a general upward trajectory of renewable energy technology. It witnessing a rapid transformation of our global energy supply systems as a result of a variety of innovative and disruptive developments and inventions in the green energy industry. It is need to overcome the obstacles face if ever going to reach the energy production goals and get off dirty fossil fuels. For those committed to achieving net-zero emissions in an effort to lessen the worst effects of climate change, the problems highlighted here make for an excellent jumping-off point. In addition, the key factors to think about when confronting the difficulties of integrating a sizable proportion of renewable energy technologies with variable outputs into energy systems.*

Keyword: *Renewable Energy Technology, Barriers to Renewable Energy, Political-Socio Challenges*

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I. Introduction

International agreements to keep the increase in global mean temperature to less than 2^{o} C relative to pre-industrial levels are a direct result of the growing public awareness of the importance of sustainable energy production in the face of global warming [1]. The transformation of the global energy system relies on two main solutions: energy efficiency and renewable energy. Although this worldwide dedication is important, it is threatened by a number of factors. These include, but are not limited to, the growth of urban populations, the rise in energy needs across multiple economic sectors (transportation, industry, housing, and commerce), the potential impact of renewable energy on mineral raw material markets, and the volatile nature of the energy market [2]. Investment in infrastructure and the launch of new productive processes that generate economic growth are essential if the goals of the Agenda for Sustainable Development are to be met [3]. These goals include, among others, the promotion of sustainable economic growth, the provision of affordable and reliable energy, the assurance of the availability and sustainable management of water, the attainment of food security, and the implementation of measures to combat climate change [4]. Due to its importance in a low-carbon energy system, the electricity sector is expected to play a leading role in the de-carbonization of the energy sector, but this could lead to an increase in carbon emissions unless massive amounts of clean energy are introduced in the coming decades [5]. The main difficulty in implementing a power system that relies heavily on renewable energy sources is the time lag between when energy is needed and when it can be generated, which occurs because renewable energy sources are inherently unpredictable [6]. Mathematical models that account for the interconnectedness of the energy sector's social, technical, economic, and environmental components are necessary to meet the challenge of transitioning from unsustainable to sustainable energy systems and solving the so-called energy trilemma of meeting demand for energy while also keeping costs down and cutting carbon emissions [7-10].

II. Barriers to Renewable Energy

There are still substantial barriers preventing widespread use of renewable energy [11]. The many potential areas of unpredictability in the energy transition planning process must be taken into account if we are to ensure a safe, stable, and reasonably priced energy supply [12-15]. Incorporating uncertainty into the process of optimising energy systems is crucial due to the dynamic nature of the parameters affecting those systems [16]. Generation and infrastructure delays, resource availability (wind and power), energy storage, price and demand swings, pollution and environmental concerns, and political issues are all examples [17-20].

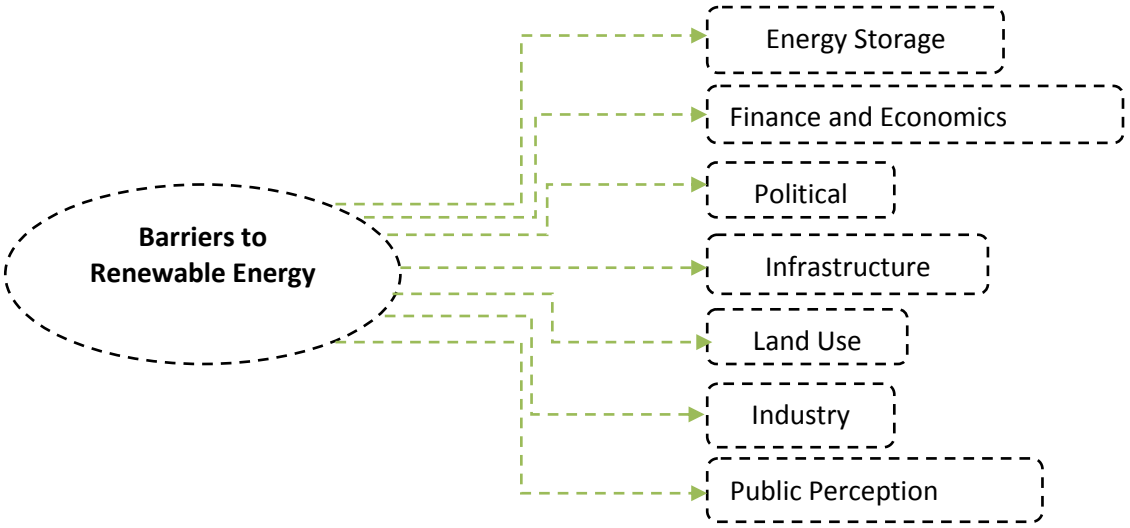

Figure 1: Obstacles Facing Renewable Energy

2.1 Energy Storage

Inconsistent supply compared to that of fossil fuel plants due to natural factors such as sunshine and wind variability. For this reason, homeowners need batteries to save power for later use. Also, to smooth out fluctuations in the power supply . The progress we have achieved in this area over the last several years is quite remarkable. As battery technology has improved, it has become more affordable. As battery technology has advanced and costs have decreased, the problem of energy storage has diminished. Even so, we still have room to improve. It should expect to see further developments in this area, including the introduction of new technologies and the widespread use of current ones, in the not-too-distant future. But sustainability issues persist, and concerns remain about the environmental consequences of technology, such as the extraction of precious metals and rare earth minerals used in battery technologies to regulate power grid output [21].

2.2 Financial and Economics challenges

The economics of the renewable energy industry is one of the main obstacles it faces. In particular, there are monetary challenges to widespread adoption of renewable energy and technology. Investment in the industry has risen considerably as a result of new commercial drivers. However, the move away from the carbon and fossil fuel business is a significant change, and with every great change comes a huge financial cost. Investment in renewables over the last several years has spawned a wave of new ideas and developments. Innovation is still stifled, though, by monetary constraints. Too frequently, the progress we need to see is slowed by a lack of financial support from huge corporations and governments hesitant to adapt as rapidly as necessary or offer incentives [22].

Crowd-funding renewable energy is one such possibility, with both new and established businesses resorting to a large number of individual investors in order to launch their projects [23].

2.3 Political-Socio Challenges

The political difficulties of making the switch to renewables are inextricably related to the economic difficulties of doing so. The renewable energy industry faces danger from political posturing, isolationism, populism, and anti-science rhetoric. Authorities in some nations are making enormous advances in the right direction, while authorities in other countries are falling behind. And when they try to balance the demands for swift and massive change with the reluctance of the voting public to make the necessary adjustments, politicians confront enormous and complicated pressures of their own. Positive sentiments toward renewable energy are growing, and the majority of the population understands and backs the need of taking swift action to address the climate disaster [24-27]. However, often renewable energy is pushed down the political agenda due to self-interest, confusion about the costs and benefits, and other day-to-day issues.

2.4 Infrastructure Challenges

It is crucial to deploy renewables on a massive scale to satisfy the energy demand. However, this transformation will be more challenging in some wealthy countries owing to the unreliability of their national energy infrastructures. Western countries have a serious infrastructure deficit that has to be addressed. Energy

infrastructure, like other types of infrastructure, is shamefully underfunded, poorly maintained, and inadequately stable or robust to fulfil the needs of the future in many locations.
The insufficiency of many electric grid systems will become an increasingly visible barrier to widespread adoption of renewable energy as the demand for such energy increases due to factors such as rising domestic use, increased adoption of electric vehicles, and the ongoing transition in the industrial sector [28].

2.5 Land Use

Juggling energy needs with other land-use priorities is one of the key issues facing the renewable energy industry today. When natural resources are already stretched thin, disagreements over land usage may quickly escalate. Where should we put farms consisting with solar panels and windmills? How can we strike a compromise between this need and the requirement for land for housing, food production, flexibility, etc.?
There is debate about whether or not to convert farmland into wind farms for the production of electricity. Still, the most valuable property is often the best location for producing energy. To thrive in the years ahead, the renewable energy industry will need to figure out how to meet rising electricity demands while also making the most efficient use of available land. While offshore wind projects have helped reduce this problem, they are still more expensive than those located on land. This is a problem that has plagued the business for some time [29-31].

2.6 Industry – The Next Frontier for Renewable Energy

De-carbonizing the sector is hampered by the lack of established energy transition paths. The pace at which things are shifting is accelerating. Environmental degradation is ongoing due to air pollution and other kinds of environmental contamination. We are putting an unprecedented burden on our land and resources.

Despite its importance to the world economy, the industrial sector is a significant source of greenhouse gas emissions. Achieving the goals of the Paris Climate Agreement and keeping global warming below 2 degrees C above pre-industrial levels depends critically on the de-carbonization of the industrial sector.

Costs for solar photovoltaic modules and other forms of renewable energy have decreased in recent years as their production has been increased on a larger scale by manufacturers. In contrast, industry has fallen far behind. There has been less progress in terms of innovation and cost reduction, with most people still using fossil fuels or natural gas, making the way ahead much less obvious[32-35].

2.7 Technical Challenges

But this isn't the only difficulty that decarburization of industry presents. Reducing CO2 emissions in this sector is made more difficult by technical factors. About 45 percent of emissions come from feedstocks, and we can't change that only by switching fuels; we have to also modify our methods of production.

It would be challenging to produce the high temperatures necessary for the activities in the target industries using alternative fuels such as zero-carbon energy. Changing the furnace design significantly would be required [36-40].

Because of how interconnected the many steps in an industrial process are, modifying any one of them will necessitate making adjustments to other steps. Due to the lengthy lifespans of industrial facilities, implementing process changes would need considerable (and expensive) rebuilding or retrofitting [41].

The de-carbonization of industry relies heavily on energy. It stands to reason that the energy system will be significantly altered by the effort to fully de-carbonize the industrial processes of the primary industrial sectors.

McKinsey believes that 25–55 EJ of low–cost, zero–carbon power per year would be needed. As it is, under a status quo scenario, annual industrial demand is just 6 EJ. De-carbonization would, without a doubt, boost power demands significantly over the long run.

Renewable energy production has seen economies of scale, advancement, cost reduction, and scale-up thanks to a joint public-private sector strategy. The same is true for our de-carbonization of industry today. Transitioning to renewable energy sources and de-carbonizing industrial processes should occur simultaneously. This is also one of the most significant obstacles facing the renewable energy industry in the future [42].

2.8 Public Perception

The difficulty of de-carbonizing industry is compounded by economic realities. Commodity items like cement, steel, ammonia, and ethylene (the industrial products responsible for the bulk of carbon emissions) are purchased based on price. Because consumers are not yet prepared to pay extra for environmentally friendly goods, de-carbonizing businesses will be the ones to bear the financial burden.

Finally, then reach the final of these formidable obstacles facing the renewable energy industry: public opinion. The public's readiness to back the move toward renewable power generation by business and utilities with both their intellectual assent and their wallets is essential [43-44].

III. Conclusion

Keeping these obstacles to renewable energy in mind, a future powered by sustainable sources of energy could seem improbable. Still, if we all work together, it's not impossible. Some nations have already made the transition to 100% renewable energy, including Iceland and Paraguay. This can be repeated anywhere in the world. Finding a way through the energy transition will need cooperation from all levels of society, not just governments and corporations.

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