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RENEWABLE ENERGY TRANSITION IN THE MIDDLE EAST AND INDIA

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ABSTRACT

Energy sources are crucial to sustain the smooth functioning of the world and its people. However, this need for energy is satisfied by fossil fuels whose combustion formulates a negative influence on the environment worldwide. This, in turn, makes a reduction in global energy consumption and climate change the most significant variables in present times. With the fast-approaching depletion of fossil fuels and a rapid growth in greenhouse gas emissions, governments throughout the world have begun developing policies and plans to create a more sustainable and environmentally friendly future. Renewable energy and technology have the potential to address these long-standing energy and environmental issues, especially in developing countries like India and The Middle East, since these countries contribute exponentially to the increasing demand for energy consumption. This paper then becomes imperative in understanding the roadmap of renewable energies in these countries and how it contributes to a more sustainable and eco-friendly future.

Introduction:

Until now, fossil fuels, such as coal, petroleum, and natural gas, have fulfilled the need for energy. To meet this need, over half of all commercial energy is imported from Asia, Africa, and Latin America. This challenge is exacerbated by the fact that the demand for electricity generation in these nations is always growing (Sopian et al., 2011), especially in developing economies like India and the Middle East. The majority of electricity generation in India is done with traditional energy sources, the most common of which are coal and fossil fuels, which contribute significantly to greenhouse gas emissions and global warming (Kumar & Majid, 2020). Likewise, energy consumption in the Middle Eastern economies has traditionally expanded faster than demand in most other areas, peaking in the 1970s. Since then, regional energy consumption has risen at a rapid pace, leading to climate change and the depletion of

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fossil fuels. The relative effectiveness of these developing economies in combating global warming is heavily dependent on present and future policy choices (El-Katiri, 2014; Sen et al., 2016). Limiting global greenhouse gas emissions has necessitated a significant transition in India and the Middle East, away from fossil fuels, as well as a huge rise in the use of renewable energy, nuclear power, carbon capture and storage, and increased energy efficiency in the last two decades (Jamil et al., 2016; Schmid, 2012). Recognizing the critical need for renewable energy sources, these growing economies have issued mandates, implemented laws, and developed new technologies to meet their energy demands during the previous two decades. As early as the 1990s, the Indian government issued its first mandate for the use of renewable energy sources (Schmid, 2012). Similarly, the Middle Eastern governments appear to be following a common template in their responses to the global shift to an energy system in which renewables play an increasingly important role (El-Katiri, 2014). While the Middle East began its wide-scale adoption later than India, both areas have made renewable energy objectives public, as well as strategies for decarbonizing upstream and downstream oil and gas activities, commissioning renewable energy projects, and increasing energy efficiency. Renewable energy technologies have already been acknowledged by these countries to have the potential to considerably cover power demand while reducing emissions. In recent years, India and the Middle East have created a sustainable energy supply strategy, for instance, the National Green Hydrogen Mission and the Pan-Arab Clean Energy Initiative respectively. Energy conservation has been pushed among residents of these countries in order to boost the use of solar, wind, biomass, waste, and hydroelectric energies (Kumar & Majid, 2020).

From being the largest consumers of energy in the world to becoming economies with the largest potential to indulge in rapid large-scale adoption of renewable energy sources, it then becomes imperative to look at the progress and policies of India and the Middle East to understand the benefits, limitations, and effects of this transition. The roadmap of renewable energy in these economies can then function as a blueprint for other developing countries to work towards a more sustainable future.

Background:

Energy has been characterized as a strategic commodity, and any uncertainty about its supply might jeopardize economic functioning, particularly in a developing nation (Sen et al., 2016). This makes energy a crucial component of socioeconomic progress. In recent decades, the rising economic expansion of emerging countries such as India and economies from the Middle East has resulted in an increase in energy consumption. This tendency is expected to continue. According to the World Energy Forum, fossil-based oil, coal, and gas stocks will be depleted in less than a decade. Fossil fuels account for more than 79% of primary energy utilized globally, with 57.7% of that amount used in transportation and quickly depleting (Kumar et al., 2010). By

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the same token, the majority of commercial energy demand in India is satisfied mostly by imported fossil fuels. In 2013, India was the world's fourth-largest user and net importer of crude and petroleum products (Sen et al., 2016). Similarly, the Middle East is a region comprised of hydrocarbon-rich nations that rely significantly on fossil fuels for energy supply and domestic consumption. Its position in the global energy market originates from its vast fossil fuel resources, which account for more than half of the world's proven crude oil reserves and one-third of the world's natural gas reserves. The fast expansion of the Middle East's Gross Domestic Product (GDP) and population boom has increased energy consumption across the region. As of 2014, this area's demand for energy accounted for 5% of world energy consumption, representing a nearly drastic increase from 1970′s levels. As a consequence, the domestic energy consumption portion of overall output has increased from 4% in 1971 to 24% in 2010 (Bayomi & Fernandez, 2019). Because India and the Middle East rely heavily on energy imports and exports, any deficit caused by an unanticipated global scenario may result in acute energy and economic scarcity, stifling industrial expansion and economic advancement. To attain energy independence, reliance on fossil fuels must be decreased, which has driven both areas to research and adopt alternative energy sources (El-Katiri, 2014; Sen et al., 2016).

In India, the promotion of renewable energy began with the establishment of a Ministry of New and Renewable Energy (MNRE) in the Department of Science and Technology in 1981. To promote renewable energy technologies across the country, MNRE developed a comprehensive variety of research, development, and demonstrative initiatives, extensive incentive programs, and state-level nodal bodies. These developments aided the renewable energy industry in India in evolving into a substantial industry (Bhattacharya & Jana, 2009). In the recent decade, India has had an annual growth rate of roughly 22% in renewable energy since the inception of MNRE (Sen et al., 2016). However, to bring renewable energy solutions at par with fossil fuels and to implement these policies for complete realization, a precondition for a larger federal budget is required to be devoted to alternative technologies (Kolisettya & Joseb, 2018).

Similarly, the impact of oil price drops in the early 2010s and the increasing number of multiple international agreements aimed at reducing dependency on fossil fuels and addressing climate change (most notably the 2016 Paris Agreement on Climate Change and the United Nations' Sustainable Development Goals) has accelerated a refocus of Middle Eastern governments on how they use energy, their persistent reliance on traditional sources of energy, and power generation methods. Since then, many Middle Eastern countries like Iraq, Iran, Yemen, and more have planned to generate 40-50% of their energy from renewable sources by 2030 (Griffiths, 2017). While there is still a lot to work with in policy development in the Middle East region, a precondition of reforming domestic energy pricing systems to reflect the comparative economic

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worth of all forms of energy technology is perhaps the most powerful instrument for Middle Eastern nations in promoting renewable energy (El-Katiri, 2014).

However, the geographical location of both the regions and the rapid growth of their economies make them the perfect candidates to move towards complete adoption of renewable energy to decrease greenhouse gas emissions, climate change, and fossil fuel depletions.

Discussion:

Renewable energy, particularly solar energy, has tremendous potential in the Middle East and India. Having understood the potential, both regions have formulated some strategies and set targets to reduce their consumption of natural energy. For instance, most of the Middle Eastern countries began working towards incorporating renewable energy into their economic systems in the early 2010s. The Kuwaiti government took steps to minimize its reliance on thermal power generation while increasing renewable energy capacity. This is projected to aid the government's goal of generating 15% of its power from renewable sources by 2030. The Egyptian government, the UAE government, and the Saudi Arabian government have also set goals in hopes of attaining a sustainable energy mix, with solar and nuclear power possibly accounting for more than half of their power supply (Global Data, 2023). Similarly, the Indian government has taken local and large-scale initiatives to introduce renewable energy in their national eco-system. A dedicated government, as well as financial and technical organizations, have assisted India in promoting renewable energy and diversifying its energy mix. For example, Indian Railways' Net Zero Emissions aim by 2030 will cut emissions by 60 million tonnes per year. In addition to meeting short-term objectives such as increasing renewables capacity to 500 GW by 2030, the country's vision is to reach Net Zero Emissions by 2070 (Ministry of New and Renewable Energy, 2022).

In order to achieve these sustainable goals, both regions have been working tirelessly to make the most out of the potential of renewable energy. To become the 5th leading country in Renewable Energy Capacity, India has implemented multiple projects over the last two decades to meet its energy and climate targets (Kolisettya & Joseb, 2018). With 250-300 days of sunlight per year, most parts of India receive 4-7 kWh of solar radiation per square meter daily, making it a supple ground for solar energy (Kumar et al., 2010). To utilize the same, since 1995, the MNRE has promoted the creation of Aditya Solar Shops in major cities around the country in order to make solar energy goods more accessible and to provide convenient after-sales maintenance services. The shops were renamed "Akshay Urja Shops" in 2015 as part of a strategy to encompass the sale and servicing of all renewable energy devices and systems, including solar energy goods (Kumar et al., 2010). Alongside this immensely successful project, other initiatives and projects were also released to fulfill the targets set by India for instance, the Pavagada Solar Park Project

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in 2016, NP Kunta Ultra Mega Solar Park in 2016, Kurnool Ultra Mega Solar Project in 2019, and Bhadla Solar Park Project commissioned in 2019, which is also one of the largest solar projects in the world (Voiland, 2022). By the same token, the Middle Eastern countries, to put their solar potential to use, have set up multiple projects in the last decade. Saudi Arabia became one of the pioneers in the Middle East with the help of a cooperative venture with the United States. The venture was among the first in the Gulf area and the Middle East to investigate and demonstrate how communities could generate electricity autonomously without being connected to central power plants. SOLERAS began operations in 1975 and completed its mission in 1997. It resulted in the building of the first solar-powered desalination plant in 2010, as part of the initial three-part program to promote solar energy development (Salam & Khan, 2018). The other countries in the region followed suit and began implementing renewable energy resources to make power production self-sufficient. For instance Al-Shegaya Solar PV plant in Kuwait, Mohammed bin Rashid Al Maktoum Solar Park in Dubai, UAE, Al Mafraq Solar PV Park, in Jordan, and more.

Both regions have also utilized other sources of renewable energy like wind power, hydropower, biomass, etc. India has established multiple wind farms like Kutch Wind Farm, Muppandal Wind Farm, and more, making the country “one of the world’s fastest growing markets for wind energy” (Kumar et al., 2010, p.2438). The Middle Eastern countries have also invested in and executed other renewable energy projects through different resources for instance Acwa is already constructing a 1.1 gigatonne wind farm at Gebel El Zeit on the Gulf of Suez, which will be the largest in the area when it comes online in late 2026. On current numbers, Egypt's anticipated total capacity of 24 gigatonnes would rank eighth in the world, while the Hatta hydroelectric power facility near Dubai is the first of its sort in the Middle East area (Mills, 2022; Dubai Electricity & Water Authority (DEWA), 2023).

With these steps towards sustainable power generation, both regions have achieved some milestones. In the previous decade, renewable energy in India has grown at a pace of roughly 22% per year. During 2013-2014, India produced around 53.22 billion units from non-conventional sources, with wind and solar accounting for 31.26 billion and 3.35 billion units, respectively (Sen et al., 2016). Solar insolation bathes Karnataka for around 300 days each year. The state has made progress by constructing high-density solar panels that receive high solar energy at rates ranging from 2000 to 2500 kilowatt-hours per square meter. This facility generates enough electricity to power nearly 700,000 homes (Elavarasan et al., 2020). Whilst the Middle East is still in the beginning stages of launching and implementing a full-scale renewable energy plan, it still has come far in the last two decades. For instance, Morocco has expanded its efforts towards sustainable development during the last five years by increasing the percentage of renewable energy and developing additional renewable energy capacity. It has built the

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world's largest solar power plant and multiple wind farms that are linked to the electrical grid. These efforts made the country from the Middle East rank 2nd worldwide in climate change control (Magoum, 2020).

However, these achievements are delayed or hindered by multiple obstacles in executing renewable energy projects/policies across both regions. India's realization of its full sustainable potential is rather difficult due to multiple fallacies in policy frameworks and general profitability surrounding renewable energy. For example, buyers are sold prefabricated projects which makes them prone to this trap in order to avoid income tax. Similarly, investors perceive a risk in the renewable industry since it offers lower gross returns, even if these returns are fairly decent by market norms. Furthermore, only in 2018 and 2019 were quality control orders issued, and there are inadequate organizations and laboratories to provide standards/certification and certify the efficacy and appropriateness of employing renewable technology (Kumar & Majid, 2020). Middle East as well, is far behind in achieving its goals for sustainability due to a plethora of reasons. Middle Eastern politics and trade appear to be the principal impediments if not the basis of the potential market danger. The investors are now concerned about the long-term viability of this firm and its linked markets (Hassan et al., 2023). Moreover, the way energy is priced domestically poses a threat to the transition towards renewable energy. This is because higher natural energy subsidies will disincentivize the Middle East's wider adaption of renewable energy (El-Katiri, 2014).

Conclusion:

The transition of the renewable energy landscape in India and the Middle East is not only imperative for their respective global standing in climate change but is also important for fulfilling the local demand for sustainability. The policies and projects in both regions are immensely backed by the local inclination towards the benefits of renewable energy. In rural India, due to the ill conditions of electricity and the high cost of Kerosene, a massive demand for off-grid solar markets has pushed policymakers and investors to subsidize renewable energy even further (Urpelainen, 2016). While there is a consensus about renewable energy in some Middle Eastern countries, like Saudi Arabia, the communication and transparency from the government side hinder them from understanding the full potential and need for renewable energy (Almulhim, 2022).

In recent years, both India and the Middle East have developed a variety of strategies to promote renewable energy production. Effective support mechanisms, as well as setting indicated objectives to elevate the number of renewables in nations' energy mixes, have been critical to the fast deployment of sustainable infrastructure. However, there is still a lack of comprehensive regulations and regulatory frameworks that are hampering the adoption of renewable

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technologies. To attract the attention of local residents and investors, the renewable energy market requires defined rules and legal procedures. Moreover, promoting renewable energy technology as a means of addressing concerns about energy security, and economic development in the face of growing energy prices, competitiveness, health expenses, and environmental degradation will be a significant part of the answer and will further aid in the formulation of proper policy frameworks.

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