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Introduction

Sustainable Development(SD) is intersection of economic growth, environmental protection and social inclusion. In order for development to be sustainable, three pillars must be held simultaneously. Unsustainable development occurs when we pursue instantaneous rewards without regard for the security of the future Earth and future generations. Meanwhile, renewable energy is at the forefront of global efforts to foster SD. It can enhance the sustainability of all economies, environment, and social inclusion.

Currently, 30% of the world's electricity comes from renewables and consumption of fossil fuel, which most countries import, is higher than ever in our history. Expanding the renewable energy industry could create numerous jobs and help a lot of nations achieve energy independence. With their own electricity generation, nations would experience more economic stability compared to relying on other countries with unevenly distributed energy resources, such as natural gas, especially during global economic downturns.



Mostly, generating electricity involves converting kinetic energy, where moving gas or liquid turns turbines. However, generating electricity from fossil fuels requires burning these fuels to boil water, which produces significant amounts of Greenhouse Gases(GHGs) and contributes to air and water pollution. Additionally, fossil fuels will eventually end up in exhaustion. Fossil fuels are finite resources, and our consumption rate far exceeds their natural replenishment. In contrast, renewable energy sources generate electricity without emitting GHGs or causing pollution. Renewable energy sources are infinite and their use can significantly contribute to mitigating climate change.

Renewable energy enables different locations, including remote and deprived areas, to have access to energy. Renewable technologies can be utilized to enhance infrastructures in regions such as medical, transportation, safety, education, housing and employment. Moreover, the use of renewable



energy will result in fewer health issues, such as respiratory or cardiovascular disease, due to lower pollution and less abnormal climate conditions due to decreased GHG emissions.

2023, United Nations Secretary General António Guterres said that “the era of global warming has ended” and “the era of global boiling has arrived”. He also highlighted the need for new national emissions targets from G20 members and urged all countries to push to reach net zero emissions by 2050. In order to foster SD, discovering measures to advance innovations in renewable energy is inevitable and should be done without any delay.

Background

The Oil Crisis, a sudden rise in the price of oil, in 1973 was the first time that the world acknowledged the significance of renewable energy. Organization of the Petroleum Exporting Countries(OPEC) had quadrupled the price of oil and it precipitated a steep recession accompanied by rising inflation. Last year, scientists from the World Meteorological Organization (WMO) and the European Commission’s Copernicus Climate Change Service said data showed that so far, July has seen the hottest three-week period ever recorded and the three hottest days on record.



Solar, Wind and Hydro Energy

Advancing innovation in renewable energy to foster SD should be kept in mind to achieve a balance between economic growth, environmental protection and social inclusion. Innovation should focus on reducing carbon footprints and mitigating climate change while preserving the ecosystems. It should also ensure the benefits of renewable energy innovations are distributed equally to promote social equality.

Representative examples of renewable energy sources include wind energy, hydroelectric energy, ocean energy and solar energy. Unlike how other renewable energy sources that use kinetic energy to produce electricity, solar energy has its unique method. Solar panels are made of photovoltaic cells that convert the sun’s energy into electricity. Photovoltaic cells are sandwiched between layers of semiconducting materials such as silicon. Each layer has different electronic properties that become energized when struck by photons from sunlight, creating an electric field.

Innovations should be evaluated not only on their technological merits but also on their contributions to long-term sustainability goals.

Problems Raised

Infrastructure Limitations



TIANMUN

Developing and deploying new renewable energy technologies require significant financial and human resources. Due to these demands, even developed countries are often reluctant to switch their existing fossil fuel-based electricity infrastructure to renewable energy systems. For Less Developed Countries(LDCs), the burden to adopt these technologies is even greater.

LDCs face penalties when transitioning to renewable energy. They pay more for electricity, cannot access renewable energy projects and are locked into fossil fuel dependency. The establishment of basic renewable energy infrastructure and the advancement of renewable energy technologies in LDCs can be technically challenging, especially in LDCs. This is because the required technologies are primarily helped by companies and necessitate substantial investment in Research and Development(R&D).



Producing Solar Panel

For example, in terms of energy, Nigeria's renewable energy potential is about 1.5 times greater than that of its fossil fuel resources. Nigeria's low level of access to power can be significantly improved and changed by different renewable energy. Despite Nigeria's desire to adopt renewable energy and natural resources in Nigeria such as silicate, lithium, zinc and cobalt which are used to make solar panels and batteries lack of financial investment, regulations and technological limitations in producing renewable energy are causing difficulties for Nigeria in renewable energy adoption.

Advancing innovation in renewable energy is crucial, but its equitable distribution is also important. While developing new technologies can drive progress, it can promote sustainability and advancement, it is important to consider how these innovations contribute to different nations and communities.

Lack of International cooperation and Knowledge-sharing

Crude Petroleum takes more than half of Saudi Arabia's export production, which is almost 236 Billion USD. Russian Federation, the third-largest producer of oil worldwide had used oil prices as its weapon toward Europe during the Russia-Ukraine war. Such countries are using their fossil fuel resources as geopolitical tools, impacting global energy markets and international relations.

Higher geopolitical tensions act as a negative global demand shock because these tensions increase uncertainty about the economic outlook, which negatively affects consumption and investment and potentially disrupts international trade. Combined, these forces lead to a contraction in global economic activity, ultimately dampening global oil demand and prices. This is known as the economic



activity channel. Also, the risk channel involves financial markets potentially pricing in higher risks to future oil supply over and above the current geopolitical shock. This increases the cash value of holding oil contracts, also known as the convenience yield, and puts upward pressure on Brent prices.



Oil Storage and Refineries in Saudi Arabia

Finding ways to advance innovation in renewable energy also should keep an eye on international relationships between different nations, firms and organizations. In addition, the intellectual property rights associated with renewable energy technologies often restrict access to critical innovations. Companies and nations that hold patents may be reluctant to share their technology with others, particularly if they acknowledge of a disadvantage such as a decrease in fossil fuel import.

International Actions

IRENA Africa Initiative

The Africa Clean Energy Corridor (ACEC) is a regional initiative to accelerate the development of renewable energy potential and cross-border trade of renewable power within the Eastern Africa Power Pool(EAPP) and Southern African Power Pool(SAPP). ACEC was formed during the Fourth Assembly of the International Renewable Energy Agency (IRENA) in January 2014, by ministers from Angola, Botswana, Burundi and 16 other nations.

The initiative builds upon the strong political commitment of African leaders to strengthen regional institutions and transmission infrastructure, forming large competitive markets and lowering costs across production sectors. By creating a larger regional electricity market, the ACEC could attract investments to meet 40–50% of power needs in the EAPP and SAPP regions by 2030.

The ACEC requires up to 25 billion USD per year of investments in power generation until 2030, with an additional 15 billion USD per year for grid infrastructure. Combined efforts will diversify resource availability, improve energy security, and foster investment opportunities and job growth. Scaling up renewable energy also offers a comprehensive opportunity to avoid carbon-intensive infrastructure lock-ins and leapfrog towards a low-carbon future.

UNSDGs

The 1992 Earth Summit in Rio de Janeiro, Brazil, laid the foundation for global environment policy, followed by the 2015 Paris Agreement which countries committed to limiting global warming to well below 2 degrees Celsius, emphasized the need for a rapid transition to renewable energy. The UN Sustainable Development Goals (SDGs) are an urgent call for action by all countries. The 17 SDGs recognize that eradicating poverty and other deprivations must be integrated with strategies to enhance health and education, reduce inequality and spur economic growth, all while addressing climate change and working to preserve our oceans and forests.



Figure 1. UN SDGs

Key Players

China

In 2020, China pledged to reach 1,200 gigawatts of renewable capacity by 2030, which was more than double its capacity at that time. At its present pace, it will meet the goal by 2025 and could boast as much as 1,000 gigawatts of solar power alone by the end of 2026. It will have a significant contribution to the 11,000 gigawatts of installed renewable capacity that the world should meet the 2030 targets of the Paris Agreement. More than half of China's total installed generation capacity is made up of non-fossil fuels now.

However, China's coal demand and production capacity remain high. Currently, one-quarter of coal used globally is burned in China to produce electricity. The government is promoting emissions reductions and improved air quality by switching to gas in industrial and residential sectors. However,

China's coal fleet is young, highly efficient and still ten times larger than its gas-fired fleet. New onshore wind and solar photovoltaic (PV) are much cheaper ways to generate electricity than new combined-cycle gas turbines (CCGTs). Under these circumstances, the major contribution of gas-fired generation to displacing coal is likely to be an indirect one, by supporting the combination of renewables.

Norway

Norway aims to become a low-emission society by 2050, leveraging its energy-rich resources. The country has strength in generating electricity using hydropower which supports high electrification with low greenhouse gas emissions. However, Norway is one of the major countries which exports oil and gas.



Figure 2. Hydroelectric Dam In Norway

Norway is a net energy exporter: in 2020, 87% of its energy production was exported. From a global perspective, Norway is the seventh-largest natural gas producer in the world, supplying 3% of global gas consumption. Norway is also a significant oil producer, accounting for 2.3% of global oil production in 2020. As a reputable and reliable producer, Norway has played a stabilizing role in the world's oil and gas supply, particularly in meeting European demand. The country's electricity generation is almost entirely renewable, with hydropower covering 92% and wind 6.5%. Despite this, Norway must expand its renewable capacity and manage challenges related to onshore wind opposition and offshore wind development.

Possible Solutions

Monitoring and Reporting

In order to advance innovations in renewable energy to foster sustainable development, monitoring how much and how efficiently renewable energies are used, is important. Also monitoring if advancement is meeting the Goals of SD can't be left out. Advancement should be protecting the environment in different ways, e.g., reducing greenhouse gas, reducing carbon footprint and mitigating climate change. Economic growth and Social inclusion should also be considered in the advancement.

International Cooperation

International cooperation is very crucial to advance innovations in renewable energy to foster sustainable development. Different nations, regions and organizations have to come together and consider community's benefit instead of merits of itself. International cooperation also results in combating climate change and a significant percentage of nations around the globe use electricity from renewable



resources by sharing technological advancements and implementing effective strategies, policies or regulations.

Glossary

GHGs(Greenhouse Gases)

Gases in Earth's atmosphere that trap heat, e.g., CO₂, CH₄, N₂O, HFCs, PFCs, SF₆ and NF₃

Photovoltaic Cells (PV Cells)

Commonly called a solar cell, is a nonmechanical device that converts sunlight directly into electricity.

Gigawatts

Unit of electric power equal to one billion (10⁹) watts.



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