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A glance on the renewable energy and sustainable economic development in Afghanistan

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Abstract:

In recent times, numerous nations have been investing in renewable energy components with the aim of mitigating greenhouse gas emissions and enhancing access to secure energy sources. Consequently, there has been a global surge in renewable energy adoption. Afghanistan's renewable energy portfolio encompasses solar, wind, hydropower, geothermal, and biomass, positioning it among the countries with the lowest levels of worldwide energy consumption. According to estimates from the Ministry of Energy and Water in Afghanistan, the nation holds a potential renewable energy resource capacity of approximately 300,000 MW. As a result, the study was initiated to explore the relationship of renewable energy and sustainable economic development in Afghanistan. Data collection involved the review of a rigorously vetted questionnaire, which underwent expert assessment for content validity. The analysis of data was executed by synthesizing inputs from specialists. A survey of 35 experts, drawn from governmental bodies, non-governmental organizations (NGOs), and academic faculties specializing in economics, participated in the study through the Delphi method.

The findings reveal that the installed capacity of renewable energy sources, rated at an average value of 94.04%, exerts the most significant influence on Afghanistan's sustainable economic progress. Following closely behind is the allocation of resources towards investment in renewable energy, with an average rating of 83.6%. Subsequently, job creation within the renewable energy sector, with a mean rating of 77.36%, and access to renewable energy sources, averaging at 69.12%, also play notable roles. By harnessing the capabilities of renewable energy technologies, Afghanistan stands poised to propel itself towards achieving its enduring objectives for sustainable development.

Key Words: Renewable Energy, Installed Capacity, Job Creation, Sustainable Economic Development

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1. Introduction:

Renewable energy refers to energy derived from sources such as sunlight, wind, geothermal, tidal, wood, waste, and biomass. Unlike conventional energy sources, renewable energy is deemed safe, environmentally friendly, and inexhaustible. Consequently, numerous governments are investing in renewable energy infrastructure to mitigate greenhouse gas emissions and bolster energy security, leading to its global proliferation. (REN21, 2012)

In Afghanistan, renewable energy resources encompass solar, wind, hydropower, geothermal, and biomass energy. Despite being a landlocked nation bordered by five others, Afghanistan has a population of less than 35 million, ranking among the countries with the lowest energy consumption rates worldwide. (Mainali & Silveira, 2013)

Moreover, it stands among the nations with minimal ecological footprint due to its geographical positioning. Hydroelectricity currently serves as Afghanistan's primary renewable energy source, facilitated by its vast mountainous terrain. The Ministry of Energy and Water estimates Afghanistan's renewable energy potential to be approximately 300,000 MW. (UNDP, 2017)

The correlation between economic development and energy usage is undeniable. Many Asian, Latin American, and African countries have transitioned from low-income to middle-income status, resulting in a surge in energy demand. However, their energy consumption patterns predominantly rely on fossil fuels, leaving rural and isolated regions devoid of adequate energy access. Consequently, these nations confront a dual energy challenge: meeting basic energy needs while ensuring sustainability. (Mun Mun Ahmed & Koji Shimada, 2019)

Amidst the burgeoning demand for renewable energy globally, particularly in the United States, Europe, and China, driven by heightened environmental consciousness, renewable energy sources accounted for approximately 16.7% of global final energy consumption in 2011. This surge in demand has spurred a 17% increase in global investment in renewable energy, fueled by cost reductions and technological advancements. (REN21, 2012)

While emerging nations undergo rapid but unsustainable economic growth, transitioning to renewable energy sources offers a pathway to sustainable development by reducing reliance on non-renewable energy. Given the high costs and limited accessibility of non-renewable energy in rural and isolated areas of these nations, renewable technologies are well-suited for localized power generation. Consequently, many developing countries are endeavoring to enhance the framework of renewable energy markets in rural and remote regions through various initiatives and regulations. (Pao, H.T & Fu, H.C, 2013)

Energy plays a pivotal role in fostering growth and competitiveness. It serves as a valuable asset and expense for producers, while also constituting a significant portion of household budgets and a financial burden for low-income families. However, the depletion of energy resources poses considerable risks to industries and households reliant on nonrenewable sources, as disruptions in supply can lead to soaring energy costs. With escalating demand and finite availability, the eventual exhaustion of nonrenewable energy supplies is inevitable. Additionally, the utilization of non-renewable energy sources contributes to pressing issues such as environmental degradation, climate change, and global warming, primarily driven by the rapid increase in greenhouse gas emissions like CO2 and methane. According to the International Energy Agency (IEA, 2009), prevailing

energy supply patterns continue to be unsustainable from economic, environmental, and social standpoints. It is projected that primary energy consumption will surge by 1.5% annually from 2015 to 2030, with fossil fuels remaining the dominant energy source. (Apergis, N & Danuletiu, D, 2014)

The transition from fossil fuels to renewable energies holds promise for mitigating environmental pollutants while sustaining economic growth endeavors, especially in light of escalating air pollution levels and the imperative to implement suitable policies for its reduction, alongside the vital need for economic development in countries like Afghanistan.

In addition to their significant potential for fostering economic growth, renewable energies also bolster and safeguard the nation's energy security, while serving as a critical element in environmental preservation efforts by curbing air pollution.

Hence, the research looks out to glance on the renewable energy and sustainable economic development in Afghanistan.

1.1 Research Objectives

1.1.1 General Objectives

The aim of the research is to study of the effects of renewable energy on the sustainable economic development of Afghanistan.

1.1.2 Specific objectives

The study is set to achieve the following objectives:

1. To determine the effect of installed capacity of renewable energy sources on the sustainable economic development of Afghanistan.
2. To identify the impact of job creation in the renewable energy sector on the sustainable economic development of Afghanistan.
3. To study the impact of investment in renewable energy on the sustainable economic development of Afghanistan.
4. To study the effect of access to renewable energy on the sustainable economic development of Afghanistan.

1.2 Research Questions

Research main question:

How does renewable energy effect on the sustainable economic development of Afghanistan?

Research sub hypothesis:

1. How does installed capacity of renewable energy sources effect on the sustainable economic development of Afghanistan?
2. How does job creation in the renewable energy sector effect on the sustainable economic development of Afghanistan?
3. How does investment in renewable energy effect on the sustainable economic development of Afghanistan?
4. How does access to renewable energy effect on the sustainable economic development of Afghanistan?

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2. Theoretical Framework

2.1 Growth Hypothesis:

The Growth Hypothesis asserts that energy usage is indispensable for economic expansion and that the significance of energy in the production process cannot be substituted by other factors, such as labor, capital investment, or technological advancements. According to this theory, reducing energy consumption could hinder economic growth. In a study spanning from 1990 to 2012, Bhattacharya et al. employed panel estimation techniques to investigate 38 major economies that produced renewable energy. They found that the adoption of renewable energy had a "considerable positive impact" on long-term economic growth in 57% of the economies analyzed. Therefore, incorporating renewable energy is crucial for expansion. (Bhattacharya et al, 2016).

From 1990 to 2010, Inglesi-Lotz examined 34 OECD countries utilizing the Pedroni co-integration approach. The results indicate a beneficial relationship between economic advancement and the utilization of renewable energy. (Inglesi-Lotz, 2016)

Murshed et al. assessed the correlation between renewable energy utilization and economic development in Argentina from 1971 to 2016. Utilizing an enhanced version of the STIRPAT model, they uncovered a long-term connection between sustainable energy and economic growth. (Murshed, et al., 2022)

2.2 Feedback Hypothesis

According to the feedback hypothesis, there exists a reciprocal relationship between energy consumption and economic development. Economic growth negatively affects energy consumption, while reducing energy usage has an adverse impact on economic advancement. (Gyimah, Yao, Tachega, Hayford, & Opoku-Mensah, 2022)

Lin and Moubarak's research findings indicate that renewable energy has contributed to China's economic expansion, underscoring how the country's economic development is propelling the growth of the renewable energy sector. (Lin & Moubarak, 2014)

Rafindadi and Ozturk examined the correlation between the utilization of renewable energy sources and economic progress. They observed that for every 1% increase in the adoption of renewable energy, the nation's economic growth rises by 0.2194 percent as it becomes more dependent on renewables. (Rafindadi & Ozturk, 2017)

Acheampong et al. discovered a positive feedback loop between the use of renewable energy and economic growth in Sub-Saharan Africa, utilizing data spanning from 1960 to 2017. (Acheampong, Dzator, & Savage, 2021)

Gyimah et al., utilizing data from 1990 to 2015, employed the Granger causality test to explore the direct and indirect impacts of renewable energy consumption on Ghanaian economic development. The study's results indicate a connection between heightened economic activity and increased utilization of renewable energy. (Gyimah, Yao, Tachega, Hayford, & Opoku-Mensah, 2022)

2.3 Conservation Hypothesis

The conservation hypothesis posits that energy consumption is intricately linked to economic growth, presenting a contrast to the growth hypothesis. This concept has garnered significant traction in recent times. Sadorsky conducted panel co-integration analyses to explore the relationship between renewable energy utilization and economic advancement across a sample of eighteen emerging economies from 1994 to 2003. The findings indicated a positive correlation between economic development and the adoption of renewable energy. Moreover, for every 1% increase in real GDP per capita, it was

projected that renewable energy usage would surge by 3.5%. This suggests that as developing economies progress, the reliance on renewable energy sources for power generation is expected to substantially rise. (Sadorsky, 2009)

For instance, Menyah and Wolde-Rufael discovered indications of a unilateral relationship between economic advancement and the utilization of renewable energy in the United States. (Menyah & Wolde-Rufael, 2010)

2.4 Neutrality Hypothesis:

The neutrality hypothesis contends that there exists no discernible connection between economic growth and energy usage. According to research findings, energy exerts minimal influence on economic expansion. Energy serves as an intermediate input, with labor and capital being the predominant factors driving production. Numerous studies indicate that, despite ample evidence suggesting otherwise, there is a lack of correlation between the adoption of renewable energy and economic development in numerous European nations. Menegaki suggested that the absence of a link between GDP growth and renewable energy utilization during this period could be attributed to the nascent stages of technology development and commercial penetration across Europe. (Menegaki, 2011)

2.5 Renewable Energy

Energy obtained from renewable natural sources is replenished at a rate faster than it is consumed. Sunlight and wind represent two examples of continuous supply sources. There exist numerous renewable energy sources accessible to all individuals. In contrast, non-renewable resources like coal, oil, and gas take hundreds of millions of years to form. The utilization of fossil fuels to generate energy results in the emission of harmful greenhouse gases such as carbon dioxide into the environment. Renewable energy production generates significantly fewer emissions compared to the burning of fossil fuels. To combat the climate crisis, it is imperative that we shift away from fossil fuels, which currently contribute the majority of emissions, and transition towards renewable energy sources. (United Nations, n.d.)

2.5.1 Installed capacity of renewable energy sources

Hydropower stands as the predominant energy source in Afghanistan, followed by fossil fuels and solar energy. Presently, just under half of the Afghan population has access to electricity, encompassing major urban centers, while many rural regions lack adequate power connections. However, the completion of the large-scale CASA-1000 project holds promise for extending electricity access to these underserved areas. Afghanistan's current energy production, derived from fossil fuels, solar energy, and various hydroelectric projects, amounts to approximately 600 megawatts (MW). Additionally, over 720 MW is imported from neighboring countries such as Uzbekistan, Tajikistan, Iran, and Turkmenistan. With a significant influx of migrant workers from neighboring nations like Iran and Pakistan, Afghanistan is anticipated to require up to 7,000 MW of power in the coming years. To address this demand, the Afghan National Development Strategy has identified wind and solar energy as valuable alternative power sources for development. As a result, multiple solar and wind farms have been constructed, with further projects in the planning stages. (Wikipedia, 2023)

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2.5.2 Solar and wind farms:

Afghanistan possesses the capacity to generate approximately 222,000 megawatts of electricity through solar energy. Solar energy is experiencing a surge in popularity across Afghanistan, with numerous cities now equipped with solar parks and all towns and cities illuminated by solar-powered street lights. Additionally, many rural residents have embraced solar panels for their energy needs. The installation and operation of wind turbines have the potential to generate approximately 66,000 megawatts of power for the nation. In 2008, the first wind farm in Panjshir Province, boasting a capacity of 100 kilowatts, was successfully constructed. A second significant wind farm is nearing completion in Herat. Collaboration between the National Renewable Energy Laboratory and the United States Agency for International Development (USAID) resulted in the development of a wind map for Herat Province, revealing a potential wind power capacity of approximately 158,000 megawatts. The construction of wind turbine farms in Herat could provide electricity to much of western Afghanistan. Additionally, smaller-scale initiatives include reservoirs capable of storing up to 15 cubic meters of water and wind pumps already operational in numerous Herat neighborhoods for well irrigation purposes. In September 2017, a 300-kilowatt wind farm in Herat was inaugurated. (Wikipedia, 2023)

2.6 Investment in renewable energy

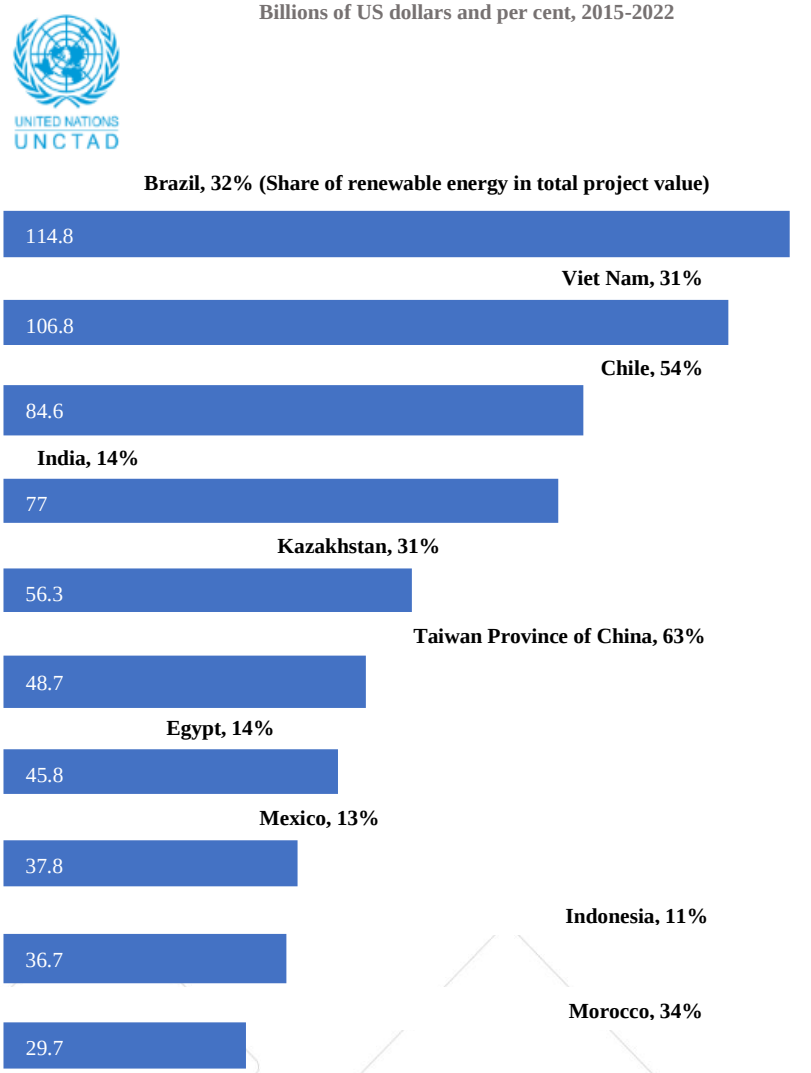
Afghanistan has augmented its energy system by 110 megawatts within the subsequent 16 months following the conclusion of a $160 million international agreement concerning solar photovoltaic and wind power projects, as reported by officials on Wednesday night. These projects, situated in Kabul, Balkh, and Herat, will be spearheaded by a local firm collaborating with partners from Turkey, India, and the US Agency for International Development (USAID). (Arab News, 2020)

The Ministry of Energy and Water reveals that Afghanistan necessitates approximately $1.5 billion in private sector investments to generate up to 2,000 megawatts of power from solar energy ventures. Despite having the potential to produce at least 222,000 megawatts of power from solar energy resources, Afghanistan presently only generates a mere four megawatts. (The Ministry of Energy and Water, 2018)

On a global scale, investments in renewable energy generation, encompassing solar and wind, have surged by 8%, contrasting with a 50% increase in 2021. Notably, the number of announced battery manufacturing projects has exceeded $100 billion by 2022. However, it is underscored that impoverished nations, which garnered only $544 billion in foreign direct investment (FDI) in clean energy in 2022, necessitate around $1.7 trillion in renewable energy investments annually. Despite the nearly twofold increase in investments in renewable energy since 2015, a significant portion of these funds has flowed into wealthier nations. The study underscores the urgent need for swift assistance to developing countries in order to attract substantially more funding for their transition to renewable energy. (UNCTAD, 2023)

Top 10 Developing economies by international investment in renewable energy

Billions of US dollars and per cent, 2015-2022



Note: Includes international project finance and greenfield investment values.

Source: UNCTAD, based on information from The Financial Times, fDi Markets(www.fdimarkets.com), and Refinitiv SA.

2.7 Job creation in the renewable energy sector

Renewable energy has proven to be a boon for employment rates, with technologies such as solar photovoltaic cells, landfill gas, and biomass plants creating more jobs per unit of energy compared to traditional sources. This positive impact on job creation is attributed to longer and more varied supply chains, heightened labor intensity, and greater net profit margins associated with renewable energy. Employment opportunities in the renewable

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energy sector span across the value chain, encompassing activities like equipment manufacturing, distribution, chemical synthesis, project management, installation, operation, and maintenance. Additionally, the expansion of renewable energy offers potential benefits for agriculture workers, especially women and young individuals, by opening up opportunities in feedstock and biomass harvesting. Furthermore, the increased availability of renewable energy can facilitate the growth of other economic activities in various industries. Notably, jobs generated by renewable energy production often come with safer working conditions. (International Labour Organization, 2021)

Despite the lingering effects of the COVID-19 pandemic and the escalating energy crisis, a recent report from the International Renewable Energy Agency (IRENA) in collaboration with the International Labour Organization (ILO) of the United Nations reveals a notable surge in employment within the renewable energy sector. Globally, the sector employed 12.7 million individuals last year, marking a significant increase of 700,000 jobs in just one year. Notably, the solar energy industry is experiencing the most rapid growth, accounting for 4.3 million jobs in 2021, which represents over one-third of the total workforce in the global renewable energy industry. (United Nations, 2022)

In 2020, the International Renewable Energy Agency (IRENA) reported that 12 million individuals worldwide were engaged in the renewable energy sector. The development of energy efficiency and related businesses undoubtedly holds the potential to generate high-quality, sustainable employment opportunities, particularly for young people. (SNV, 2022)

2.8 Access to renewable energy

Afghanistan relies heavily on imports, sourcing 78% of its grid power from neighboring countries such as Turkmenistan, Tajikistan, Iran, and Uzbekistan. In 2021, the nation faced a dire risk of power shortages, as only 38% of its 38 million citizens had access to electricity. (The Borgen Project, 2022)

According to the World Bank's 2018 report, a mere 28% of Afghanistan's population has access to renewable energy, primarily due to insufficient infrastructure and the high costs associated with renewable energy sources. Despite efforts by the government and various international organizations to improve renewable energy access in Afghanistan, progress has been hindered by ongoing security concerns and financial constraints. (World Bank, 2018)

Many developing nations possess abundant renewable energy resources, including solar energy, wind power, geothermal energy, and biomass. These nations also have the capability to manufacture the labor-intensive systems required to harness these resources. By harnessing such energy sources, developing nations can reduce their dependence on oil and natural gas, resulting in energy portfolios that are less vulnerable to price fluctuations. Moreover, in numerous instances, investments in renewable energy can be more cost-effective than traditional fossil fuel-powered systems. (Flavin & Aeck, 2005)

2.9 Sustainable economic development

Often, there's a misconception that sustainability and economic development are at odds with each other, when in fact, they can complement one another without sacrificing either. In many instances, investing in sustainability can actually lead to positive economic growth outcomes, and vice versa. Additionally, there's a common misunderstanding that

sustainability is solely about the natural environment. Sustainability encompasses a broad spectrum of meanings, varying from person to person. At the 2016 Annual Conference in Cleveland, Ohio, the Sustainability Advisory Committee of the International Economic Development Council and the Urban Sustainability Directors Network convened economic development and sustainability directors. One result of that meeting was agreement on the following concept of sustainable economic development:

The investment in business, social, built, and natural environments that creates increasing prosperity for all, now and into the future. (International Economic Development Council, 2017)

2.10 Sustainable economic development in Afghanistan

Afghanistan's economy is experiencing instability, heavily dependent on foreign aid, and its private sector lacks strength. Over the past couple of years, there has been a significant 25% decline in the economy. Although exports hit a peak of $1.9 billion in 2022, they have since dwindled since the beginning of 2023. Despite facing a trade deficit, the Afghani currency has appreciated, impeding hopes for domestic manufacturing and trade recovery. From April 2023 onwards, the nation has been grappling with deflation, which is likely attributable to increased supply, the strengthening of the Afghani currency, and the economy still adapting to persistently lower overall demand. (The World Bank, 2023)

Numerous businesses are encountering challenges in operating at full capacity. According to the third phase of the Private Sector Rapid Survey conducted between March and April 2023, slightly over half of the evaluated businesses were functioning at full capacity, while approximately one-third were operating below their usual capacity. The primary constraints reported by surveyed firms included decreased demand, followed by apprehensions about the future, and limitations in the functionality of the banking system. (The World Bank, 2023)

3. Literature Review

Researchers have conflicting views on the correlation between increasing the utilization of renewable energy sources and bolstering the economy. Konuk et al. examined this association in emerging nations' context, suggesting that the use of biomass energy and economic expansion may not coexist harmoniously. (Konuk, F, Akpinar, S, & Yildiz, S, 2021)

The financial ramifications of transitioning to produce renewable energy sources were also scrutinized in Jenniches' comprehensive review. He emphasized the importance of selecting appropriate technology and evaluation timeframes.(Jenniches, 2018)

Doytch and Narayan delved into the impact of industrial and service sector growth on the utilization of both renewable and nonrenewable energy resources. Their findings indicate that renewable energy tends to benefit high-growth sectors like the service industry in developed countries and the industrial sector in emerging economies. (Doytch, N & Narayan, S, 2016)

Acheampong et al., employing the GMM-PVAR technique, revealed a bidirectional causal relationship between renewable energy consumption and economic growth. (Acheampong et al, 2021). Contrary to some views, Islam et al. argue that the adoption of renewable energy does not impede economic growth. (Islam et al, 2022)

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Conceptual Framework

The relationship describes the association between the factors that stand independently and those that are reliant on them. The framework offers an appropriate structure to investigate how the enduring economic progress of Afghanistan is influenced by factors such as the capacity of renewable energy sources, employment opportunities in the renewable energy domain, financial backing for renewable energy projects, and the availability of clean energy resources.

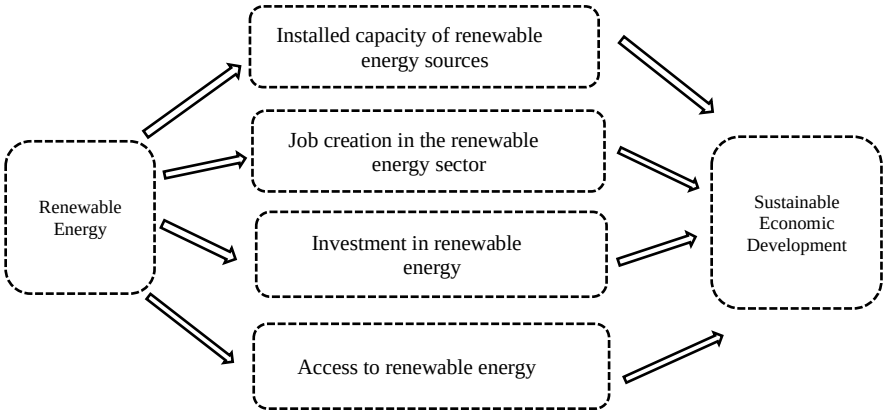


Figure 2: Conceptual framework of the hypothesized model illustrating the proposed relationship between the variables.

4. Research Methodology

This section outlines the approach utilized for conducting the current study. The study is categorized as applied in terms of its purpose, and it employs a field-library research approach for data collection. The research method adopted is descriptive-content analysis, conducted through the Delphi technique.

4.1 Study Population and Sampling

The study targeted individuals with expertise working within the National Environmental Protection Agency, Directorate of Energy and Water, and the Directorate of Economy, as well as economic specialists teaching in universities and working in relevant NGOs. A total of 35 specialists were randomly chosen from this population based on their availability.

4.2 Data Collection Tool

A questionnaire served as the instrument for data collection. The questions were structured in a qualitative and descriptive manner to gather the opinions of experts regarding the impacts of renewable energy on the sustainable economic development of countries. These opinions were then analyzed and synthesized.

5. Research Findings

The major aspects of renewable energy identified by the panel of respondents in two rounds of survey are as follows;

Job creation in the renewable energy sector

1. The workforce trained in renewable energy technologies will significantly drive economic growth and innovation in Afghanistan.
2. The potential of job creation in the renewable energy sector will reduce unemployment, poverty, and improve livelihood in Afghanistan.
3. Skilled workforce in the renewable energy sector will enhance the overall competitiveness of Afghanistan's economy and attract foreign investment.
4. Job creation in the renewable energy sector should be prioritized by government policies for the future economic prosperity of Afghanistan.
5. The current level of job creation in the renewable energy sector as a driver for sustainable economic development in Afghanistan is considered satisfactory.

Installed Capacity of Renewable Energy Sources

1. The government and private sector stakeholders should collaborate on increasing the installed capacity of renewable energy sources for the future economic prosperity of Afghanistan.
2. The potential of increasing the installed capacity of renewable energy sources will reduce unemployment and poverty in Afghanistan.
3. An increasing installed capacity of renewable energy sources will enhance the overall competitiveness of Afghanistan's economy and attract foreign investment.
4. The current level of installed capacity of renewable energy sources as a driver for sustainable economic development in Afghanistan is considered satisfactory.
5. A higher installed capacity of renewable energy sources will drive economic growth and innovation in Afghanistan.

Access to renewable energy

1. The expansion of renewable energy sources should be prioritized by the government and private sector stakeholders of Afghanistan for achieving sustainable economic growth in upcoming years.
2. Increasing access to renewable energy will drive innovation and technological advancement in various sectors of the Afghanistan economy.
3. Access to renewable energy will create new job opportunities and stimulate economic activity in Afghanistan.
4. Increased access to renewable energy will lead to long term economic stability and growth in Afghanistan.
5. The current level of access to renewable energy infrastructure in Afghanistan is considered satisfactory for future economic prosperity.

Investment in renewable energy

1. Policies that encourage investment in renewable energy for promoting sustainable economic development in Afghanistan over the upcoming years are supported by stakeholders.
2. Prioritizing renewable energy investments can help diversify and strengthen Afghanistan's economy.

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3. The government and private sector should collaborate on increasing investments in renewable energy for the future economic prosperity of Afghanistan.
4. The potential of increased investment in renewable energy sources will reduce dependence on imported fuels and enhance energy security in Afghanistan.
5. Increased investment in renewable energy will have the potential to reduce poverty and improve living standards in Afghanistan.
6. Increased investment in renewable energy will create long-term economic benefits for Afghanistan.
7. The impact of increased investment in renewable energy on sustainable economic development in Afghanistan for the upcoming years will be highly satisfactory.

In the third stage of the survey, the group of participants posed questions and prioritized the indicators and sub-indicators based on their importance. Using a Likert scale (ranging from 1= very low to 5= very high), the panel members ranked all the indicators, as depicted in the table below.

Table 1 Prioritized the indicators by research respondents through Likert Spectrum Scale

Priority	Indicators	Agreed mean of respondent out of 5	Percentage
Installed Capacity Renewable Energy Sources			
1	The government and private sector stakeholders should collaborate on increasing the installed capacity of renewable energy sources for the future economic prosperity of Afghanistan.	4.89	97.8%
2	The potential of increasing the installed capacity of renewable energy sources will reduce unemployment and poverty in Afghanistan.	4.82	96.4%
3	An increasing installed capacity of renewable energy sources will enhance the overall competitiveness of Afghanistan's economy and attract foreign investment.	4.76	95.2%
4	The current level of installed capacity of renewable energy sources as a driver for sustainable economic development in Afghanistan is considered satisfactory.	4.63	92.6%
5	A higher installed capacity of renewable energy sources will drive economic growth and innovation in Afghanistan.	4.41	88.2%
Investment in renewable energy			
6	Policies that encourage investment in renewable energy for promoting sustainable economic development in Afghanistan over the upcoming years are supported by stakeholders.	4.34	86.8%
7	Prioritizing renewable energy investments can help diversify and strengthen Afghanistan's economy.	4.31	86.2%
8	The government and private sector should collaborate on increasing investments in renewable energy for the future economic prosperity of Afghanistan.	4.25	85%
9	The potential of increased investment in renewable energy sources will reduce dependence on imported fuels and enhance energy security in Afghanistan.	4.20	84%
10	Increased investment in renewable energy will have the potential to reduce poverty and improve living standards in Afghanistan.	4.10	82%
11	Increased investment in renewable energy will create long-term economic benefits for Afghanistan.	4.05	81%
12	The impact of increased investment in renewable energy on sustainable economic development in Afghanistan for the upcoming years will be highly satisfactory.	4.01	80.2%
Job creation in the renewable energy sector			

13	The workforce trained in renewable energy technologies will significantly drive economic growth and innovation in Afghanistan.	3.97	79.4%
14	The potential of job creation in the renewable energy sector will reduce unemployment, poverty, and improve livelihood in Afghanistan.	3.92	78.4%
15	Skilled workforce in the renewable energy sector will enhance the overall competitiveness of Afghanistan's economy and attract foreign investment.	3.86	77.2%
16	Job creation in the renewable energy sector should be prioritized by government policies for the future economic prosperity of Afghanistan.	3.82	76.4%
17	The current level of job creation in the renewable energy sector as a driver for sustainable economic development in Afghanistan is considered satisfactory.	3.77	75.4%
Access to renewable energy			
18	The expansion of renewable energy sources should be prioritized by the government and private sector stakeholders of Afghanistan for achieving sustainable economic growth in upcoming years.	3.74	74.8%
19	Increasing access to renewable energy will drive innovation and technological advancement in various sectors of the Afghanistan economy.	3.51	70.2%
20	Access to renewable energy will create new job opportunities and stimulate economic activity in Afghanistan.	3.48	69.6%
21	Increased access to renewable energy will lead to long term economic stability and growth in Afghanistan.	3.45	69%
22	The current level of access to renewable energy infrastructure in Afghanistan is considered satisfactory for future economic prosperity.	3.1	62%

1. Installed capacity of renewable energy sources

According to experts, Afghanistan's ability to utilize renewable energy sources holds promise in enhancing energy stability by reducing the country's reliance on imported fossil fuels. This transition not only assists in stabilizing energy costs but also reduces susceptibility to fluctuations in the global oil market, ensuring a more dependable and environmentally friendly energy supply for both businesses and households. Enhancing energy stability not only stimulates investment but also supports sustainable economic growth, laying the foundation for enduring development. Furthermore, by harnessing the potential of renewable energy technologies, Afghanistan can advance its sustainable development goals, promote social inclusiveness, and drive economic progress. The adoption of renewable energy sources in Afghanistan can thus exert a varied and extensive influence on fostering sustainable economic advancement.

2. Investment in renewable energy

Experts suggest that directing investments towards renewable energy offers a promising path for Afghanistan to diminish its dependency on fossil fuels, thus bolstering energy stability, generating employment prospects, drawing in investment, and encouraging innovation, all of which can significantly drive sustainable economic progress. By prioritizing the development of clean energy infrastructure and diversifying its energy resources, Afghanistan can not only reduce its environmental impact but also fortify itself against energy emergencies and alleviate the repercussions of climate change. This shift towards renewable energy not only has the potential to fuel economic growth but also creates fresh opportunities for entrepreneurship, extends electricity accessibility, and

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fosters comprehensive development by providing job prospects to various sectors of society, including disadvantaged communities, women, and youth. Ultimately, channeling investments into renewable energy is poised to guide Afghanistan's economy towards enhanced sustainability and prosperity.

3. Job creation in the renewable energy sector

Experts underscore the significant potential of creating job opportunities in Afghanistan's renewable energy sector to drive the nation's enduring economic advancement by addressing critical challenges and capitalizing on avenues for growth. Essentially, the establishment of employment in renewable energy provides a pathway to diminish the country's dependence on fossil fuels and traditional energy sources, thus enhancing energy security and resilience. This effort to generate employment in renewable energy also promotes comprehensive progress by offering individuals from various backgrounds and skill sets the opportunity to participate in economic expansion. The sector acts as a channel for economic empowerment, especially for marginalized communities, women, and young people, as it requires a diverse workforce encompassing engineers, technicians, project managers, and administrative personnel. By leveraging the potential of the renewable energy industry, Afghanistan can not only nurture more sustainable economic development but also alleviate poverty, enhance the long-term prosperity and welfare of its residents, and promote social inclusion and capacity enhancement.

4. Access to renewable energy

Upon scrutinizing the insights of experts, it became evident that embracing renewable energy holds the potential to catalyze a profound transformation in Afghanistan's sustainable economic progression. This shift entails reducing dependence on expensive and volatile fossil fuels, enhancing energy security, and promoting environmental sustainability. Access to renewable energy sources like solar, wind, and hydropower can yield a stable and cost-effective electricity supply, sparking economic growth, job generation, attraction of investments, and heightened efficiency across various sectors. By expanding access to clean energy, Afghanistan can curtail energy expenses, boost energy effectiveness, and stimulate innovation and entrepreneurial endeavors, thereby fostering a more resilient, inclusive, and prosperous economy. Furthermore, endeavors in renewable energy can mitigate emissions of greenhouse gases, diversify the nation's energy portfolio, and alleviate the impacts of climate change, charting a path toward a more environmentally aware and sustainable development trajectory for Afghanistan.

6. Conclusion

In summary, renewable energy emerges as a transformative power in Afghanistan, offering considerable potential to drive ongoing economic growth for the nation. The utilization of renewable energy sources' capability has the capacity to strengthen energy security, reduce reliance on imported fossil fuels, and establish a stable and sustainable energy supply, ensuring stability for businesses and consumers alike. The establishment of job opportunities within the renewable energy sector not only tackles significant obstacles but also fosters societal inclusivity, skill enhancement, and economic empowerment, especially for marginalized groups, women, and young individuals.

Investing in renewable energy infrastructure can mobilize resources, unveil new business opportunities, and stimulate innovation while simultaneously reducing greenhouse gas emissions and enhancing resilience against energy disruptions. Access to renewable energy has the potential to strengthen Afghanistan's economy, making it more resilient, inclusive, and prosperous by lowering costs, increasing efficiency, fostering innovation, and promoting environmental sustainability. By leveraging the potential of renewable energy technologies, Afghanistan can achieve its long-term sustainable development goals, catalyze economic progress, and enhance the overall well-being of its population. Embracing renewable energy as a fundamental component of its developmental strategy will propel Afghanistan toward a more sustainable and flourishing future.

7. Recommendations

1. It's crucial to promote investments in renewable energy projects by both public and private entities to encourage innovation, generate new business opportunities, and reduce greenhouse gas emissions. Diversifying energy sources and investing in environmentally friendly infrastructure will not only boost economic growth but also enhance resilience against fluctuations in the energy market and mitigate the effects of climate change.

2. Boosting energy security, decreasing reliance on imported fossil fuels, and stabilizing energy costs require increased investment in renewable energy infrastructure from both governmental entities and corporate stakeholders. These efforts are positioned to stimulate economic advancement and attract investments by establishing a more reliable and sustainable energy framework for households and businesses.

3. Establishing policies and initiatives to encourage job openings in the renewable energy industry is crucial, particularly targeting the expansion of employment opportunities for marginalized groups, women, and young individuals. This sector holds the capacity to address poverty and drive sustainable economic progress by promoting diversity and fostering the development of skills.

4. Enabling wider availability of renewable energy sources like solar, wind, and hydroelectric power is essential to reduce energy expenses, improve effectiveness, and encourage innovation and entrepreneurial activities. Accessibility to eco-friendly energy is pivotal in strengthening Afghanistan's economy, making it more robust, inclusive, and flourishing, all while promoting environmental sustainability and enhancing efficiency across various industries.

References

1. Acheampong, A., Dzator, J., & Savage, D. (2021). Renewable energy, CO2 emissions and economic growth in sub-Saharan Africa: Does institutional quality matter? *J. Policy Model*, 1070-1093.
2. Acheampong, A.O, Dzator, J, & Savage, D.A. (2021). Renewable energy, CO2 emissions and economic growth in sub-Saharan Africa: Does institutional quality matter? J. Policy Model. 1070-1093.
3. Apergis, N, & Danuletiu, D. (2014). Renewable energy and economic growth: Evidence from the sign of panel long-run causality. *International Journal of Energy Economics and Policy*, 578-587.
4. Arab News. (2020, September). Retrieved from Arab News: https://www.arabnews.com/node/1739641/business-economy
5. Bhattacharya, M., Paramati, S., Ozturk, I., & Bhattacharya, S. (2016). The effect of renewable energy consumption on economic growth: Evidence from top 38 countries. *Appl. Energy*, 733-741.
6. Doytch, N, & Narayan, S. (2016). Does FDI influence renewable energy consumption? An analysis of sectoral FDI impact on renewable. *Energy Econ*, 291-301.
7. Flavin, C., & Aeck, M. (2005). *ENERGY FOR DEVELOPMENT: The Potential Role of Renewable Energy in Meeting the Millennium Development Goals*. Retrieved from https://en.wikipedia.org/wiki/Renewable_energy_in_developing_countries#cite_note-mdg-4
8. Gyimah, J., Yao, X., Tachega, M., Hayford, I., & Opoku-Mensah, E. (2022). Renewable energy consumption and economic growth: New evidence from Ghana. *Energy*.
9. Inglesi-Lotz, R. (2016). The impact of renewable energy consumption to economic growth: A panel data application. *Energy Econ*, 58-63.
10. International Economic Development Council. (2017). *Common Measures of Sustainable Economic Development.* Ohio.
11. International Labour Organization. (2021). *Green jobs and renewable: low carbon, high.* International Labour Organization.
12. Islam, M, Irfan, M, Shahbaz, M, & Vo, X.V.. (2022). le and non-renewable energy consumption in Bangladesh: The relative influencing profiles of economic factors, urbanization, physical infrastructure and institutional quality. *Renew. Energy*, 1130-1149.
13. Jenniches, S. (2018). Assesing the regional economic impacts of renewable energy sources A literature review. Renew. Sustain. Energy. 35-51.
14. Konuk, F, Akpinar, S, & Yildiz, S. (2021). Biomass energy consumption and economic growth: Further evidence from NEXT-11. *Energy Rep*, 4825-4832.
15. Lin, B., & Moubarak, M. (2014). Renewable energy consumption—Economic growth nexus for China. *Renew. Sustain. Energy Rev*, 111-117.
16. Mainali, B., & Silveira, S. (2013). Alternative pathways for providing access to electricity in developing countries. *ScienceDirect*, 299–310. doi:https://doi.org/10.1016%2Fj.renene.2013.01.057
17. Menegaki, A. (2011). Growth and renewable energy in Europe: A random effect model with evidence for neutrality hypothesis. *Energy Econ*, 257-263.
18. Menyah, K., & Wolde-Rufael, Y. (2010). CO2 emissions, nuclear energy, renewable energy and economic growth in the USA. *Energy Policy*, 2911-2915.
19. Mun Mun Ahmed, & Koji Shimada. (2019). The Effect of Renewable Energy Consumption on Sustainable Economic Development: Evidence from Emerging and Developing Economies. *Energies.*
20. Murshed, M., Rashid, S., Ulucak, R., Dagar, V., Rehman, A., Alvarado, R., & Nathaniel, S. (2022). Mitigating energy production-based carbon dioxide emissions in Argentina: The roles of renewable energy and economic globalization. *Environ. Sci. Pollut. Res.*
21. Pao, H.T, & Fu, H.C. (2013). The causal relationship between energy resources and economic growth in Brazil. *Energy Policy*, 793-801.
22. Rafindadi, A., & Ozturk, I. (2017). Impacts of renewable energy consumption on the German economic growth: Evidence from combined cointegration test. *Renew. Sustain. Energy Rev*, 1130-1141.
23. REN21. (2012). *Renewables 2012 Global Status Report.* Retrieved from www.ren21.net
24. Sadorsky, P. (2009). Renewable energy consumption and income in emerging economies. *Energy Policy*, 4021-4028.

25. SNV. (2022, August 30). *Generating sustainable jobs in the renewable energy sector*. Retrieved from SNV: https://www.snv.org/update/generating-sustainable-jobs-renewable-energy-sector
26. The Borgen Project. (2022, Oct). Retrieved from The Borgen Project: https://borgenproject.org/renewable-energy-in-afghanistan/
27. The Ministry of Energy and Water. (2018, December). *Tolonews*. Retrieved from Tolonews: https://tolonews.com/business/renewable-energy-projects-need-15b-investment-ministry
28. The World Bank. (2023, Oct). *The World Bank in Afghanistan*. Retrieved from The World Bank: https://www.worldbank.org/en/country/afghanistan/overview
29. UNCTAD. (2023). *WORLD INVESTMENT REPORT*. Retrieved from UNCTAD-Prosperity for all: https://unctad.org/publication/world-investment-report-2023
30. UNDP. (2017). *"The Power of Nature: How Renewable Energy is Changing Lives in Afghanistan"*.
31. United Nations. (2022, September 22). *Climate and Environment*. Retrieved from United Nations: https://news.un.org/en/story/2022/09/1127351#:~:text=Worldwide%20employment%20in%20the%20renewable,IRENA)%20in%20collaboration%20with%20the
32. United Nations. (n.d.). *United Nations-Climate Action*. Retrieved from United Nation: https://www.un.org/en/climatechange/what-is-renewable-energy#:~:text=Renewable%20energy%20is%20energy%20derived,that%20are%20constantly%20being%20replenished.
33. *Wikipedia*. (2023). Retrieved from Wikipedia: https://en.wikipedia.org/wiki/Energy_in_Afghanistan#cite_note-tvnews1-7
34. Wikipedia. (n.d.). *Energy for Development:The Potential Role of Renewable Energy in Meeting the Millennium Development Goals*. Retrieved from https://en.wikipedia.org/wiki/Renewable_energy_in_developing_countries#cite_note-mdg-4
35. World Bank. (2018). *Afghanistan Renewable Energy Development Issues and Options.*