



Energy Transition and Sustainable Development in GCC Countries: Strategic Pathways and Policy Implications

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Abstract

Purpose- This paper aims to highlight the importance of energy transition in shaping the future development of Gulf Cooperation Council (GCC) countries. The region's heavy reliance on non-renewable energy sources-primarily oil and natural gas-poses significant risks to long-term economic stability and development sustainability. In addition, the paper examines the environmental impact of fossil fuel consumption, including greenhouse gas emissions, air pollution, and ecosystem degradation. It examines the increasing threat of climate change as a global and regional challenge. By exploring these dimensions, the paper promotes a strategic shift toward renewable energy adoption and sustainable energy alternatives across the GCC. **Design/Methodology/Approach-** This paper uses both descriptive and analytical methodologies to analyse the role of energy transition in advancing sustainable development. Drawing on data published by international organisations and national governments, the paper critically assesses the strategic benefits of enhancing renewable energy capacity. It explores how transitioning to cleaner energy sources contributes to environmental sustainability, economic resilience, and social equity, while identifying key policy measures and institutional frameworks that facilitate this transformation. **Findings-** The existing literature on Energy offers extensive insights into the dynamics of energy transition and the crucial role that renewable Energy plays in shaping long-term sustainability. Building on this foundation, our findings underscore the positive impact of Energy transition on environmental management practices. Specifically, the shift toward green energy sources contributes to reducing ecological degradation, enhancing resource efficiency, and mitigating climate-related risks-thereby reinforcing the broader imperative of safeguarding planetary health. **Originality/Value-** The originality of this paper stems from its focused analysis of the energy transition and its implications for the long-term sustainability of Gulf Cooperation Council (GCC) countries. It provides a timely and comprehensive examination of recent governmental initiatives across the region aimed at accelerating the shift toward renewable energy sources and enhancing environmental protection. Furthermore, the paper engages with contemporary debates surrounding the urgent environmental imperative for clean Energy, situating the GCC's transition within broader global discourses on climate resilience and sustainable development.

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Abstract

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Keywords: *climate change mitigation, economic resilience, environmental sustainability, institutional capacity, policy frameworks, sustainable development*

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1. INTRODUCTION

The energy transition is essential for a sustainable future in the Gulf Cooperation Council (GCC) countries, including Saudi Arabia, the United Arab Emirates, Kuwait, Oman, Qatar, and Bahrain. For decades, economic development in these countries has been shaped by revenues from conventional energy sources, mainly oil and gas, promoting economic growth and improving living standards. Income from energy production and export has constituted the bulk share of government expenditure on development initiatives, highlighting the sector's central role in national economies. Public investment has catalysed growth across multiple sectors, stimulating job creation and enabling significant infrastructure development. As a consequence, the contribution of the public sector has enabled governments to exert considerable influence over all dimensions of human development.

However, fossil fuels are finite resources, and continued reliance on them poses significant threats to environmental health, climate stability, and long-term sustainability. Energy remains a cornerstone

of economic progress and a critical enabler of capacity-building for a resilient future. In 2024 alone, global energy demand rose by 2.2% with electricity demand increasing by 4.3%, outpacing global GDP growth. More than 80% of this demand came from emerging economies, emphasizing how energy access directly fuels development. At the same time, renewables accounted for 38% of new energy supply, highlighting their growing role in building resilient, future-ready economies.

Participation in the 21st-century global economy, shaped by innovative technologies and the Fourth Industrial Revolution, will increasingly depend on the adoption of renewable energy sources and the deployment of smart infrastructure. It is therefore vital for GCC countries to accelerate their energy transition efforts to harness emerging technologies and mitigate the risk of economic and technological stagnation. Although renewable investments are accelerating, the region must overcome regulatory fragmentation, inconsistent policy incentives, and the absence of unified regional energy markets to fully unlock the potential of clean energy.

Goal 7 of the United Nations Sustainable Development Goals (SDGs) emphasizes universal access to affordable, reliable, and sustainable energy. Achieving this goal not only ensures energy availability but also catalyses progress across other Sustainable Development Goals, including poverty alleviation, reduction of inequalities, education, health, and environmental protection. Estimates suggest that meeting SDG 7 will require annual global investments in energy transition ranging between USD 4.2 and 4.5 trillion (IEA, 2025). This highlights the initiatives undertaken by GCC countries to diversify their energy portfolios, reduce dependence on fossil fuels, and advance sustainable development. The energy transition presents strategic opportunities, particularly for nations with limited conventional energy reserves, to meet domestic energy demands and support inclusive growth. The declining cost of renewable technologies in recent years has further incentivised investment in clean energy solutions. Additionally, the paper explores the potential impact of energy transition on sustainable development in the Gulf region and its role in enhancing these countries' capacity to engage competitively in the global economy of the 21st century.

The purpose of this paper is to address a critical gap in the existing literature on energy transition, particularly within the context of the GCC. By offering new analytical insights and evidence, the study contributes to a deeper understanding of the region's transition dynamics and challenges. The findings aim to support policymakers in designing effective strategies, while also enriching the knowledge base available to students and researchers working on energy transition and sustainable development.

2. ENERGY TRANSITION: A PATH TO SUSTAINABILITY

Energy is a key driver of development, shaping economic, social, political, and environmental dimensions. Historically, the advancement of human civilisations has been closely tied to the ability to harness diverse energy sources—enhancing human capabilities and enabling the generation of income and wealth. Energy has empowered societies to innovate, create new products, eradicate poverty, boost productivity, and even venture beyond our planet. In today's context, isn't easy to envision how nations can effectively confront environmental challenges or make meaningful progress toward sustainable development without a reliable and sufficient energy supply. Investing in the energy transition opens the door to diverse opportunities — driving economic growth, reducing environmental pollution, strengthening energy security, building human capabilities, and attracting foreign direct investment. The recent thrust in energy transition is driven by the urgent need to protect the planet, reduce reliance on fossil fuels, diversify energy sources, and promote long-term sustainability.

Energy transition refers to the systemic shift from fossil fuels—such as oil, gas, and coal—toward renewable energy sources to ensure energy security and promote sustainable development. It encompasses a transformation in how energy is produced, distributed, and consumed. It is defined as the “shift from relying on fossil fuels to using clean, renewable energy sources like wind, solar, hydropower, and biomass. This transition is essential for reducing greenhouse gas emissions, combating climate change, building energy security into the system globally, and creating a sustainable energy system. It involves not only generating electricity from renewables, but also transforming other sectors, like transportation and heating, to use clean energy. The ultimate goal is to build an energy system that is environmentally friendly, reliable, resilient and fair for all. It represents a fundamental transformation in

how we power our homes, businesses, and societies.” (University of Cambridge, 2025). Diversifying the energy mix helps mitigate geopolitical risks and supply disruptions, and this shift is driven by policy reform, technological innovation, and environmental stewardship. In the case of the Gulf countries, the energy transition is a strategic foundation for diversifying economic structures and building the infrastructure of an innovative, knowledge-driven economy. It generates strong forward and backward linkages by creating demand for outputs across multiple industries while also serving as a key input for most productive sectors. This stimulates domestic markets for manufacturing, capital equipment, construction, and related services. Consequently, investment in energy transition positions these countries to advance the three core priorities of a modern energy system: sustained economic development and growth, reliable energy access and security, and long-term environmental sustainability (World Economic Forum, 2020b).

Importantly, energy transition is not solely about environmental protection or mitigating future supply risks—it represents a transformative shift in how humanity generates and utilises power. In recent years, technological advancements in energy systems have significantly improved our ability to extract energy from natural resources. Looking ahead, continued innovation holds the potential to reshape our world, offering a cleaner environment and a healthier planet. Recent advancements in digital technologies are making energy systems more intelligent, connected, reliable, efficient, and sustainable. These technologies can accelerate the deployment of transformative solutions across sectors, driven by innovative and resilient energy infrastructure. Across all market activities, digital tools enhance energy efficiency and reduce operational costs. If countries strategically invest in appropriate technologies, they can unlock substantial benefits. Technologies that leverage local resources can mitigate economic disruption, reduce global dependence, and strengthen sustainable capacity. (Al-Roubaie, 2018)

Governments in the Gulf region must formulate effective strategies for a sustainable future that address current challenges and offer solutions to reduce dependence on fossil fuels while minimising exposure to market vulnerabilities. Such a strategy should support a long-term transition toward a sustainable energy supply that can meet future demand for affordable, reliable, and low-carbon energy. Public policy also has a critical role in building institutional and human capacity to support emerging models enabled by technological innovation, improved access to energy information, and global collaboration. Leveraging the opportunities created by smart technological innovation, digital services, social networks, and globalisation will be essential for accelerating this transition. (IEA, 2017)

Energy transition strengthens national adaptability, mitigates market vulnerabilities, and underpins sustainable development. The urgency to move away from fossil fuels should catalyse increased investment in renewable energy derived from inexhaustible natural resources. Strategic efforts must promote the adoption of innovative technologies, expand access to financing, and strengthen international partnerships to meet the rising demand for clean energy. Building capacity for renewable energy requires coordinated collaboration between the public and private sectors. The private sector contributes through capital investment and technological innovation, while governments play a vital role in creating enabling environments and offering incentives to attract both domestic and foreign firms. Such conditions are essential for launching and scaling new renewable energy projects. Currently, fossil fuels account for approximately 80% of global energy consumption. In contrast,

renewable energy sources comprised about 18% of the total energy mix in 2023. Within the electricity sector, the share of renewables is projected to rise from 30% in 2023 to 46% by 2030, with most of this growth driven by solar and wind technologies (IEA, 2024).

Despite this progress, the benefits of renewable energy remain unevenly distributed. More than 2 billion people still rely on polluting and hazardous energy sources—such as firewood, charcoal, and other traditional fuels—for daily cooking needs. In sub-Saharan Africa, least-developed countries have an average installed renewable energy capacity of only 40 watts per capita, compared to 1,100 watts per capita in developed nations (World Bank Group, 2025). Key barriers to equitable access include insufficient financing and inadequate infrastructure. Urgent reforms to the global financial system are needed to ensure that developing countries receive fair and adequate support to expand clean energy access and achieve sustainability goals.

Energy availability is strongly correlated with economic growth and rising living standards, as it fuels market activity and drives productivity. Investment in energy transition infrastructure fosters localised knowledge creation, technological innovation, job generation, and industrialization. As the World Economic Forum notes: “Delivering a sustainable, secure and equitable energy future in a multi-speed world requires more than coordination—it calls for careful navigation of complex trade-offs and a rethinking of how policies, markets and institutions interact. Key structural shifts are needed to facilitate adaptation to diverse starting points, resource endowments and transition capacities.” (World Economic Forum 2025, P. 43).

Energy demand is shaped by a range of interrelated factors, including population growth, economic expansion, urbanisation, rising living standards, environmental pressures, policy frameworks, and technological innovation. These forces influence both the supply and demand for green energy, affecting a country’s capacity to produce and adopt environmentally sustainable solutions. Green energy—sourced from renewables such as solar, wind, hydro, and wave power—offers a cleaner alternative to fossil fuels by addressing climate change, reducing pollution and waste, and fostering innovation across sectors. According to IEA, renewables accounted for the largest share of the growth in total energy supply (38%), followed by gas (28%), oil (11%) and nuclear (8%) in 2024. (IEA, 2025)

Energy transition plays a pivotal role in enhancing energy security, mitigating climate change, and improving the efficiency of Earth’s natural resources. With the global population currently at 8 billion and projected to reach 10 billion by 2050, transitioning to sustainable energy sources is essential for meeting basic human needs and supporting continued economic growth. Sustainable energy practices are critical to protecting biodiversity and preserving the planet’s capacity to support life. Nearly 55% of global GDP—estimated at US\$58 trillion—is derived from activities linked to the natural environment and its services, rising from US\$44 trillion in 2020. The planet’s deteriorating health represents a profound threat to human survival, undermining the very foundation of our future sustainability. (PWC, 2023)

A significant challenge facing many countries is securing energy to meet domestic demand while ensuring universal access to affordable and sustainable energy and minimising its contribution to climate change. For developing nations, energy is critical for increasing production, generating income, and advancing human development. It also plays a vital role in reducing the adverse health impacts associated with the use of fuelwood, coal, and agricultural waste. In these contexts, access to clean and affordable

energy is a prerequisite for building the capabilities needed to reengineer development and sustain future growth. The energy transition enables countries to enhance energy security by shifting from traditional fossil fuels to more reliable and environmentally friendly sources. Energy resources are generally classified into two categories: renewable and non-renewable. Renewable energy is derived from natural sources that replenish continuously, ensuring an indefinite supply. Familiar sources include solar, wind, hydro, hydrogen, and biomass. These energy forms offer several advantages, including mitigating climate change, producing minimal pollution, and delivering reliable and affordable power.

Transitioning to cleaner energy sources is indispensable for meeting basic human needs and fostering inclusive economic growth. The energy demand is shaped by multiple factors, including population growth, urbanisation, rising living standards, environmental degradation, government policy, and technological advancement. These forces collectively influence a country’s capacity to produce and sustain clean energy. Renewable energy offers environmentally friendly solutions by addressing climate change, reducing waste and pollution, and encouraging innovation. According to recent research by the London Stock Exchange Group (LSEG), the amount of investment required to effectively address climate change is unprecedented. Their analysis estimates that achieving global climate goals—particularly those aligned with a net-zero pathway—will demand cumulative investments ranging from US\$109 trillion to US\$275 trillion by 2050. LSEG’s 2024 and 2025 green economy reports emphasise that this investment surge is essential not only for mitigating climate risks but also for unlocking new economic opportunities. The green economy already generates more than US\$5 trillion in annual global revenues, and the projected investment flows will accelerate its growth and structural transformation. (Dai, 2025) Investing in the energy transition is far more complex than simply scaling up renewable energy or deploying new low-carbon technologies. As Daniel Yergin argues, the transition demands a fundamental restructuring of the energy systems that support the world’s US\$100 trillion economy. This includes transforming the physical infrastructure, supply chains, market structures, and geopolitical relationships that have been built over more than a century around fossil fuels. Yergin highlights that the global economy is deeply intertwined with existing energy foundations—oil, gas, and coal—which currently supply around 80% of the world’s energy. Shifting away from this entrenched system requires substantial amount of investment in new infrastructure, new approaches to energy security and greater cooperation between developed and developing countries. (Yergin, 2022)

Global investment in the energy transition reached an unprecedented \$2.4 trillion in 2024, representing a 20% increase over the 2022–2023 average. The most rapid expansion occurred in electric vehicles, where spending rose 33% to \$763 billion, and in solar power, which grew 49% compared to previous benchmarks. Overall renewable-energy investment also strengthened, climbing from an average of \$662 billion in 2022–2023 to \$807 billion in 2024. In the United States, the transition is especially notable: 92% of new electricity-generation capacity expected this year and next is projected to come from clean energy sources. (Neufeld, 2025)

The energy transition plays a crucial role in improving the well-being of current generations while safeguarding the ability of future generations to meet their own energy needs. However, many developing countries remain heavily reliant on traditional energy sources—such as biomass, agricultural waste, and fossil fuels—that undermine environmental quality, threaten public health, and weaken long-term economic resilience. This dependence is

often reinforced by structural challenges, including limited access to affordable financing, inadequate technological infrastructure, and insufficient institutional capacity to adopt and scale modern energy solutions. As a result, progress toward cleaner and more sustainable energy systems in these regions remains slow, despite the significant social and economic benefits that such a transition could unlock.

Designing reliable and affordable energy model that is tailored to local environmental, economic, and social conditions is fundamental to minimising pollution, reducing resource waste, and supporting long-term sustainability. Such design is especially important in regions where climatic variability, geographic constraints, and socio-economic disparities shape energy demand and supply options. At the same time, the intensifying global debate over climate change, energy security, environmental degradation, energy poverty, and the pressures of economic growth has heightened expectations for an energy model capable of delivering clean, accessible, and dependable power for all. Governments, international organisations, and communities are increasingly recognise that energy is not merely a technical sector; it is a foundational driver of human development, social equity, and national resilience.

The success of the energy transition in sustaining future growth and protecting ecosystems depends on the policies and strategies adopted both locally and globally. In an interconnected world, international collaboration is essential not only for an inclusive transition but also for addressing shared global challenges. Energy transition is key to promoting sustainable energy systems and building resilient economies grounded in equity and justice. As the International Renewable Energy Agency (IRENA) notes, “Renewables can provide a more secure alternative to fossil fuels by increasing the diversity of energy sources through local generation, thus contributing to system flexibility and improving resistance to shocks.” (IRENA, 2020, P.59)

Currently, 1.1 billion people—14% of the global population—lack access to electricity. Additionally, 2.8 billion people, primarily in developing countries, rely on traditional energy sources such as biomass and inefficient technologies, which harm human health, contribute to climate change, and degrade ecosystems. Without clean and affordable energy, it will be impossible to mitigate pollution and achieve sustainable development. Recent advancements in renewable energy technologies have significantly reduced costs affordability, especially for developing countries where technical, financial, and managerial capacities are often insufficient. These cost reductions have opened new opportunities to invest in clean energy, reduce uncertainty about future energy needs, and protect the environment.

3. SUSTAINABLE ENERGY

Sustainable energy encompasses natural sources that cannot be depleted over time and can meet human needs without risking exhaustion. It offers a pathway to reduce dependence on finite resources and meet global energy demands indefinitely. Sustainable energy is defined by three key characteristics: renewable - originates from sources like sunlight and wind that naturally replenish, clean - produces minimal pollutants and greenhouse gases, making it safer for both the environment and human health, and impact - causes little or no harm to ecosystems, habitats, and communities, thereby preserving biodiversity and natural landscapes. (AQ Energy, 2024)

Despite these advancements, millions of people —primarily in developing countries—still face unreliable and unaffordable energy sources. In these countries, limited access to clean energy worsens inequality, poverty, public health challenges, and deforestation. Globally, electricity as a clean and reliable energy source is pro-

jected to increase from 30% in 2023 to 46% by 2030, with solar and wind driving most of this growth (IEA, 2024, p.14). A successful energy transition must ensure equitable access to safe, affordable energy, enabling inclusive development and progress toward the Sustainable Development Goals. Countries with limited energy supply should leverage existing solar and wind resources to build renewable electricity capacity. By 2030, renewables are projected to supply half of global electricity demand. Electricity is a cornerstone of development and a powerful tool for poverty alleviation. The rapid evolution of the worldwide energy transition—propelled by innovation, climate action, and sustainability imperatives—demands supporting environments that foster investment in energy research, technology transfer, effective regulatory frameworks, digital competencies, and robust public-private partnerships. Countries with limited energy supply should capitalise on their solar and wind potential to expand renewable electricity generation.

For many countries—especially those with limited technical and financial resources—building capacity for renewable energy remains a significant hurdle, i.e. the transition is not without challenges. Traditional energy sectors may face job losses, requiring workers to acquire new skills and undergo continuous training to meet evolving market demands. Battery storage technologies are emerging as critical solutions, enabling the storage of renewable energy to address shortages and meet fluctuating demand. These innovations pave the way for sustainability and enhance the potential for smart cities and global energy self-sufficiency. In contrast, conventional energy models generate waste and pollution, contributing to climate change. In short, achieving a successful transition, energy policies must be mainstreamed into economic, industrial, labour, educational and social policies (IRENA, 2020).

Access to global markets and international collaboration is essential for facilitating knowledge exchange, attracting foreign direct investment, and encouraging multinational enterprises to establish operations, particularly in developing regions. Public-private cooperation plays a pivotal role in risk-sharing, joint research and development, entrepreneurship promotion, and driving sustainable transformation. Similarly, regional collaboration is vital for exchanging expertise, understanding market dynamics, and evaluating the developmental impact of energy transition across borders. Joint initiatives can support the creation of intelligent energy systems that ensure future energy security, stimulate cross-border economic growth, and create employment opportunities. Globally, the energy sector is projected to employ 100 million people by 2050, including 7.3 million in the Middle East and North Africa (MENA) region. Of these, 42 million jobs are expected to be in renewable energy, with MENA accounting for 2.1 million—roughly 5% of global employment in renewables. In contrast, employment in conventional energy sectors is anticipated to decline, with the MENA region facing a 25% reduction in fossil fuel-related jobs by 2050. (IRENA, 2020)

A viable business model for the future must be rooted in a transitional energy system that protects the environment, guarantees affordable energy access, and promotes inclusive economic development. Such a model enhances national capabilities, fosters entrepreneurial ecosystems, sustains long-term growth, and advances equity. The energy transition also catalyzes the emergence of new industries in manufacturing, research and development, digital technologies, and innovative urban infrastructure—marking the shift toward a post-oil economy. However, a successful business model for the future must be anchored in a transitional energy system that safeguards the environment, ensures affordable access to energy, and promotes inclusive economic growth. Such a model enhances

human capabilities, stimulates entrepreneurship, sustains long-term development, and promotes equity. The energy transition also catalyses the emergence of new industries across manufacturing, research and development, digital technologies, and smart cities—ushering in a post-oil era.

To be effective, an energy transition model must be built on three strategic pillars: international collaboration, integrated policy frameworks, and inclusive innovation ecosystems (IRENA, 2024). Implementing these pillars will reinforce the foundational dimensions of sustainable development: economic viability, social equity, and environmental protection. In this context, the energy sector must be integrated with the broader socio-economic system, recognising the interdependence between energy and economic development. Energy is a key driver of productivity, job creation, poverty alleviation, and the diffusion of innovation. Investments in renewable energy strengthen cross-sectoral linkages, drive technological advancement, and expand overall market activity. These linkages attract both domestic and international firms to invest in productive ventures, increasing demand for inputs across the energy sector and the broader economy. As emphasised by IRENA: “Energy is an integral part of the economy, interacting with every other economic sector, affecting relative wages and generating income to be spent in other sectors. Thus, labour impacts of the transition reach beyond the energy sector.” (IRENA, 2020, P.148).

Over the past three decades, renewable energy technologies have become significantly more efficient, affordable, and reliable—enabling many countries to produce clean energy at lower costs. This transformation offers new opportunities for nations with limited energy resources to adopt advanced technologies and build capacity for sustainable development through accessible and cost-effective means. Many developing countries possess abundant, perishable natural resources that can be harnessed continuously at minimal cost. By leveraging these assets, they can accelerate their energy transition, reduce dependency on fossil fuels, and unlock pathways to inclusive and resilient growth.

4. ENERGY TRANSITION FOR SUSTAINABLE DEVELOPMENT

Energy derived from conventional sources—including oil, gas, and coal—has shaped the economic trajectory of nations since the onset of the Industrial Revolution, generating both positive and negative externalities. Fossil fuels have long powered the rise of modern civilisations, fueling industrial growth, technological innovation, higher living standards, and rapid urbanisation. However, they are also responsible for many of today’s environmental crises, contributing to approximately 70% of global greenhouse gas emissions and being linked to one in five deaths worldwide (Living Planet Report, 2024). In light of these consequences, investing in renewable energy is imperative to mitigate the harmful effects of fossil fuels on human societies and reduce the risk of environmental degradation. Achieving this objective requires coordinated international efforts to reimagine the global energy system and scale up investment in renewable energy production. Such efforts are essential to securing a sustainable energy supply and reversing the adverse impacts of fossil fuels on biodiversity.

The concept of sustainable development, as defined in Our Common Future by the World Commission on Environment and Development, is “a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development and institutional change are all in harmony and enhance both current and future potentials to meet

human needs and aspirations” (United Nations, 1987, p. 46). At its core, sustainable development seeks to balance essential human needs—such as food, water, energy, and shelter—with the preservation of the natural environment. Energy plays a pivotal role in enhancing human capabilities to safeguard ecosystems and contribute to long-term sustainability. Human activity has already significantly altered 75% of terrestrial and 66% of marine environments (World Economic Forum, 2020a).

Human needs are primarily met through natural resources, many of which are non-renewable and require careful, efficient use to ensure continued availability. Simultaneously, the natural environment offers abundant renewable sources that can be cultivated to enhance the ecosystem’s carrying capacity and support human survival. Sustainable energy refers to inexhaustible resources found in nature—such as solar, wind, hydro, biomass, and geothermal—that can be used repeatedly without risk of depletion. In contrast, fossil fuels are finite; once consumed, they are irretrievably lost.

Sustainable energy systems not only foster economic transformation and ensure energy security but also safeguard the environment. According to the Organisation of Petroleum Exporting Countries (OPEC), global GDP is projected to grow from \$125 trillion in 2020 to approximately \$270 trillion by 2045, with India and China accounting for 37% of global income. Concurrently, global energy demand is expected to rise from 275.4 million barrels of oil equivalent per day (mboe/d) in 2020 to 352 mboe/d by 2045. Meeting this surge in demand while sustaining development will depend heavily on the availability and scalability of renewable energy sources. The contribution of renewables to global energy demand is projected to increase from 6.8 mboe/d in 2020 to 36.6 mboe/d by 2045, positioning them as the most significant contributor to the future energy mix. (OPEC, 2021)

To secure future energy supplies and preserve ecosystems, energy systems must evolve to become more diverse, sustainable, and accessible—particularly for populations in low-income countries. Clean and reliable energy should be universally available, and emerging business models must address waste reduction at both local and global levels to promote equitable resource distribution. For example, while 30–40% of all food produced is wasted, millions continue to suffer from hunger. If current consumption patterns persist, by 2050 the planet would require the equivalent of 7.42 Earths to sustain lifestyles like those in Argentina, 6.83 for Australia, 5.55 for the United States, 2.94 for South Africa, 0.90 for Indonesia, and 0.85 for India (*Living Planet Report*, 2024). The global food system alone accounts for 82% of agricultural land use, 90% of deforestation, 70% of freshwater withdrawals, and 86% of species at risk of extinction (Living Planet Report, 2024). To ensure food security, annual investment must rise to between US\$390 billion and US\$455 billion. These initiatives will succeed only if the natural environment is protected from degradation and climate change through investment in green energy and the adoption of environmentally friendly technologies. The energy transition must align with environmental protection—especially in developing countries—to enhance human capabilities, reduce pollution, minimise waste, and preserve ecosystems.

Over the past few decades, substantial investment has been directed toward the energy transition. Global renewable energy capacity has doubled, and the costs of solar and wind energy have declined by up to 85%. Nevertheless, rising energy demand will require annual investment in renewables to triple—from an estimated US\$1.5 trillion in 2022 to US\$4.5 trillion by 2030. This increase is critical to curbing environmental degradation, protecting ecosystems from further deterioration, and ensuring that the planet’s carrying

capacity continues to support sustainable and affordable access to basic needs.

In the Gulf Cooperation Council (GCC) region, governments have announced a collective investment of US\$100 billion in renewable energy projects by 2030, aiming to diversify energy sources and reduce dependence on fossil fuels. Despite their vast renewable energy potential, only 0.6% of electricity in the GCC is currently generated from renewables (Carbon Credits, 2025). The energy transition offers these countries a pathway to achieving future policy goals, including reducing dependence on fossil fuel, ensuring secure and reliable energy, expanding inclusive access to electricity, and promoting sustainable development. Recent advances in technological innovation and declining costs are making the energy transition increasingly cost-effective, enabling climate-risk mitigation and supporting long-term sustainability.

5. GCC: STRATEGIC INITIATIVES FOR ENERGY TRANSITION

The Gulf Cooperation Council (GCC) countries play a pivotal role in the global energy market, producing approximately 30 million barrels of oil per day and holding over 30% of the world's proven oil reserves. Historically, oil revenues have transformed these nations into modern economies with high living standards and robust socio-economic development. Today, the GCC states possess abundant renewable resources—particularly solar, bioenergy, hydrogen, and wind—that can be harnessed through cost-effective technologies to support energy transition and reduce dependence on fossil fuels. In addition to these natural advantages, they have the financial and technical capacity to develop nuclear energy through the establishment of nuclear power plants. Strategic investment in energy transition enables these countries to meet future energy demands while maintaining their status as major global energy producers. Among them, the United Arab Emirates (UAE) leads the region, accounting for approximately 60% of total renewable energy capacity and over two-thirds of regional investment in renewable energy initiatives.

Despite their energy wealth, heavy reliance on oil revenues poses long-term risks to energy security and sustainable development. Continued production and consumption of fossil fuels will inevitably deplete reserves, underscoring the urgency of diversifying energy portfolios. Regional governments have begun to embrace alternative energy technologies and reinvest oil income into renewable energy initiatives. Encouragingly, several Gulf states have launched ambitious plans to expand their energy mix, adopt innovative technologies, and reduce carbon emissions. Sustaining growth will require meeting the needs of growing populations, creating employment opportunities, reducing inequality, and fostering economic resilience.

The Gulf region's ability to harness innovative technologies—propelled by the Fourth Industrial Revolution—depends on its capacity to invest in innovation, research and development, institutional reform, and human capital. Currently, most GCC countries are consumers rather than producers of emerging technologies. Localising technology is essential to improving efficiency and enhancing domestic capabilities, enabling nations to benefit from the energy transition and support sustainable development fully. (Al-Roubaie, 2017) Technological advancements have already improved the efficiency of the global energy system by 7%, measured by the total energy required to meet end-use demand (Energy Institute, 2025).

To accelerate progress, GCC countries must jointly develop a transition model driven by a transformative agenda that promotes public-private partnerships, regional collaboration, knowledge

creation, and investment in R&D. The natural environment should be central to this agenda—reducing dependence on fossil fuels, enhancing energy security, promoting regional development, and sustaining economic growth. For success, transformative decisions must be inclusive and collectively agreed upon, ensuring that all citizens benefit from the new energy paradigm. This requires well-crafted policies that offer incentives, funding, digital infrastructure, innovative technology adoption, and skilled workers. Human capital plays a decisive role in shaping the energy transition. Educational institutions must be actively involved in training, reskilling, research, and industry collaboration. Building a skilled workforce is essential for scaling renewable energy and securing a sustainable future. With shared environmental and natural characteristics, GCC countries can leverage comparative advantages in energy production, distribution, and use. As the World Economic Forum emphasises, “Policy-makers and private sector actors must work together and seize the opportunities to build the foundation for a resilient energy transition—one that not only ensures long-term sustainability but also delivers inclusive growth and long-term prosperity” (World Economic Forum 2021, P.43).

The potential for renewable energy in the Gulf is vast. Strategic investment in renewables positions these countries to become future leaders in the production and export of clean energy. Harnessing energy from natural sources not only capitalises on the region's resource abundance but also benefits from the sharp decline in the costs of solar and wind technologies. Between 2010 and 2019, the cost of solar energy fell by 85%, while wind power declined by 55%. These reductions make renewable energy more affordable and accessible, supporting a sustainable future. Moreover, clean energy investments have become both economically viable and environmentally essential. Policy intervention will be critical to facilitate energy transition, ensuring that affordable and sustainable technologies are acquired and adapted to build intelligent energy systems.

For GCC countries, investing in energy transition science is especially urgent, given their reliance on non-renewable energy sources. Over the past several decades, economic growth in the region has been driven by revenues from fossil fuel production and exports. In 2023, oil and gas revenues accounted for 34% of GDP in Saudi Arabia, 30% in the UAE, 38% in Oman, 35% in Kuwait, 39% in Qatar, and 26% in Bahrain—making these economies heavily dependent on external sources to finance development. Transitioning to renewable energy is therefore not just a strategic choice; it is a necessity for economic stability and long-term sustainability. (Gulf Investment Corporation 2024)

Across the region, governments must invest in renewable energy to reduce economic dependence on fossil fuels. Strategic initiatives should lay the foundation for an efficient transition to clean energy. In recent years, Gulf governments have increasingly partnered with private firms to diversify energy portfolios and achieve sustainability goals. They can also leverage existing technologies from other regions to develop domestic capabilities in solar panels, wind turbines, and energy storage systems—reducing reliance on conventional energy and supporting long-term sustainability. The UAE and Oman have set net-zero targets for 2050, while Saudi Arabia, Bahrain, and Kuwait have committed to achieving net-zero emissions by 2060.

GCC countries view energy transition both as a challenge to their oil-based economies and as an opportunity to secure future energy supplies and stimulate economic growth. Their dependence on oil revenues remains substantial: approximately 56% in Saudi Arabia, 61.8% in Bahrain, 68% in Oman, 50% in the UAE, and 87%

in Kuwait (KAMCO Invest 2024). This fiscal reliance underscores the vulnerability of these economies to global oil price fluctuations and market volatility, which can disrupt budgetary planning, public investment, and long-term development strategies. Instability in international oil prices and uncertainty surrounding future energy demand underscore the urgency of diversifying energy sources. Reducing economic vulnerability and ensuring supply security require proactive policy interventions, strategic investment, and regional cooperation. (Al-Sarihi, 2025)

Recognising this risk, GCC governments are increasingly positioning energy transition as a strategic imperative—not only to diversify their energy mix but also to future-proof their economies. The shift toward renewables offers a pathway to reduce fiscal exposure, enhance energy security, and unlock new sectors for innovation and employment. It also aligns with broader national visions—such as Saudi Arabia’s Vision 2030 (Peninsula, 2025) and the UAE’s Energy Strategy 2050—which emphasise sustainability, technological advancement, and economic diversification. (TDRA, 2025)

Moreover, the energy transition presents an opportunity to reconfigure the region’s development model by investing oil revenues into high-impact sectors such as clean energy infrastructure, green hydrogen, smart grids, and energy storage systems. These investments can catalyse industrial transformation, attract foreign direct investment, and foster regional leadership in emerging energy markets. By leveraging their financial capacity, natural resource endowments, and strategic geographic location, GCC countries can become global hubs for renewable energy innovation and export.

However, the success of this transition ultimately hinges on each country’s ability to implement coherent policy frameworks, strengthen domestic capabilities, and cultivate the human capital needed to sustain long-term progress. It will also require inclusive governance mechanisms that ensure the benefits of energy transition are equitably distributed across society—particularly among youth, women, and marginalised communities. In this context, energy transition is not merely a technical shift but a socio-economic transformation that must be managed with foresight, resilience, and regional cooperation.

Financially, all Gulf Cooperation Council (GCC) nations possess the capacity to accelerate investment in clean energy, thereby ensuring future energy availability, affordability, and resilience. The success of the energy transition hinges on these economies’ ability to reduce reliance on conventional sources—primarily oil and gas—and embrace renewable alternatives such as solar, wind, hydro, wave, and hydrogen energy. Unlike non-renewable resources, which are depleted faster than they can be naturally replenished, renewable energy comes from sources that regenerate over time, providing a sustainable pathway to long-term energy security. Fossil fuels, formed over millions of years, are finite and increasingly vulnerable to geopolitical and market disruptions. Their substitution with clean, inexhaustible alternatives is both an environmental necessity and an economic imperative.

Governments across the Gulf are adopting a dual energy strategy: leveraging the current fossil fuel-driven economy while simultaneously expanding investments in clean energy technologies. This approach enables them to maintain competitiveness in global energy markets while gradually building domestic capacity for renewable energy production. It also reflects a pragmatic recognition of the need to balance short-term economic stability with long-term sustainability goals. (Al-Roubaie, 2019a)

Expanding clean energy infrastructure not only mitigates environmental risks but also opens new avenues for industrial diversification, job creation, and technological innovation. By leveraging their

financial strength, natural resource endowments, and strategic geographic position, GCC countries are well-placed to emerge as global leaders in renewable energy production and export—so long as they continue investing in institutional reform, human capital development, and inclusive innovation ecosystems. Their ability to diversify energy portfolios, scale clean-energy infrastructure, and attract international partnerships will further determine the pace of this transformation. Moreover, sustained commitment to research, local manufacturing, and technology transfer will be essential for building long-term competitiveness in the global green economy.

5.1. Saudi Arabia

Saudi Arabia is rapidly transforming its energy landscape through bold investments in renewable energy, aligning with Vision 2030 and its Net Zero 2060 pledge. The Kingdom aims to generate 50% of its electricity from renewables by 2030, reducing reliance on fossil fuels and curbing carbon emissions. Central to this effort is the Saudi Green Initiative, which aims to add 58.7 GW of renewable capacity, including solar, wind, and green hydrogen projects. (Climate Scorecard, 2025)

Flagship developments include the Sakaka Solar Plant (300 MW) and the Dumat Al Jandal Wind Farm (400 MW), both operational and contributing to the national grid. NEOM, the futuristic city in northwest Saudi Arabia, is set to become a global hub for clean energy, with plans for a \$5 billion green hydrogen facility powered entirely by renewables. Additionally, the Renewable Energy Project Development Office (REPDO) is overseeing competitive tenders for solar and wind farms nationwide, attracting global investors and developers. Saudi Arabia is also investing in grid modernisation, energy storage, and smart metering to support the integration of intermittent renewables. These efforts reflect a strategic shift toward sustainability, economic diversification, and regional leadership in the global energy transition.

Artificial intelligence (AI) is a strategic pillar in Saudi Arabia’s energy transition. The \$500 billion NEOM project is designed to operate entirely on intelligent energy systems powered by renewables. AI plays a central role in producing, distributing, monitoring, and managing infrastructure, enabling digitally driven services across transportation, healthcare, security, and other sectors. As an intelligent system, AI analyses real-time data to optimize infrastructure performance and predict malfunctions before they occur, reducing operational risks. Across economic sectors, AI facilitates predictive maintenance, identifies consumption patterns, and enhances energy efficiency—strengthening system reliability, balancing supply and demand, minimising waste, and lowering costs.

5.2. United Arab Emirates

The United Arab Emirates (UAE) has emerged as a regional pioneer in renewable energy development, driven by its updated UAE Energy Strategy 2050 and a commitment to achieving net-zero emissions by mid-century. Central to this vision is the Mohammed bin Rashid Al Maktoum Solar Park in Dubai, the world’s largest single-site solar park, which aims to reach 5,000 MW capacity by 2030. As of early 2025, commissioned projects at the park already deliver 2,860 MW through photovoltaic and concentrated solar power technologies, with the sixth phase underway. The park also hosts the region’s first solar-powered green hydrogen pilot, positioning the UAE at the forefront of hydrogen innovation. (Government of Dubai, 2023)

Nationally, the UAE plans to triple its renewable energy share and increase installed clean energy capacity from 14.2 GW to 19.8 GW by 2030. These efforts are backed by AED 150–200 billion in planned investments, targeting a 30% clean energy mix and the creation of

50,000 green jobs. Wind energy, smart grids, and solar-integrated urban planning further diversify the energy portfolio, while entities like DEWA and Masdar lead implementation through public-private partnerships and international collaborations. The UAE's approach blends infrastructure with policy reform, technological innovation, and global diplomacy.

5.3. Oman

Oman has made significant strides in advancing renewable energy as part of its national strategy to diversify its energy mix and achieve net-zero emissions by 2050. Anchored in Oman Vision 2040, the country is accelerating its transition from a gas-dominated system to one powered increasingly by solar and wind technologies. The Authority for Public Services Regulation (APSR) and Nama Power and Water Procurement Company (PWP) are spearheading this transformation through ambitious projects and regulatory reforms.

By 2025, Oman had already commissioned central solar installations like Ibri II and Manah I & II, each with a capacity of 500 MW. Looking ahead, APSR plans to implement six large-scale renewable projects by 2027, including the Ibri III Solar Plant (500 MW), Duqm Wind Farm (250 MW), and Mahout I Wind Project (up to 400 MW). Additionally, 29 solar projects generating 1,000 MW and multiple wind farms are scheduled for rollout by 2029, culminating in a landmark 3,000 MW solar initiative by 2030. (PV Magazine 2025). To support these developments, Oman has introduced technical guidelines for small-scale solar PV systems and electric vehicle charging infrastructure, promoting decentralised clean energy adoption. The country also launched strategic studies on energy storage and demand response, ensuring grid reliability and economic feasibility as renewable penetration increases.

5.4. Kuwait

Kuwait has significantly accelerated its renewable energy agenda in alignment with its Vision 2035 and global sustainability commitments. The Ministry of Electricity, Water and Renewable Energy (MEWRE) is spearheading over 15 strategic projects under the 2025/26 development plan, including the expansion of the Subiya and Nuwaiseeb power plants and integration with the Shagaya Solar Power Plant. Notably, Kuwait aims to increase its renewable energy share from 15% to 30% by 2030 and reach 50% by 2050, as announced by the Kuwait Institute for Scientific Research (KISR). The Shagaya Renewable Energy Park, now entering its second and third phases, is central to this transition, targeting an additional 5,000 megawatts of clean energy capacity. (Arab Times, September 2025)

International collaboration also plays a pivotal role. Kuwait's ministerial committee, chaired by His Highness the Prime Minister, is actively implementing agreements with China to advance renewable infrastructure, low-carbon recycling, and environmental resilience. The Kuwait Fund for Arab Economic Development complements these efforts by financing regional green projects, including hydropower in Nepal and wind energy in Jordan. Moreover, Kuwait Sustainable Energy Week (KSEW) 2025 will convene global experts and stakeholders to foster innovation and policy dialogue, reinforcing Kuwait's role as a regional leader in clean energy transformation.

5.5. Qatar

Qatar has increasingly positioned itself as a regional leader in renewable energy innovation, aligning its national development strategy with global decarbonisation goals. Central to this effort is the Al Kharsaah Solar Power Plant, Qatar's first large-scale photovoltaic facility, which began full operations in 2022. With a capacity of 800 MW, it supplies up to 10% of the country's peak

electricity demand, significantly reducing reliance on natural gas for domestic power generation. The project, developed through a public-private partnership involving QatarEnergy and international firms, exemplifies Qatar's commitment to diversifying its energy mix while leveraging its financial and technological capabilities. (TotalEnergies, 2025)

Beyond infrastructure, Qatar is investing in research and policy frameworks to support long-term sustainability. The Qatar National Research Fund (QNRF) has launched multiple initiatives to advance solar efficiency, energy storage, and smart grid technologies. Meanwhile, the Ministry of Environment and Climate Change is working to integrate renewable energy targets into broader climate adaptation strategies, including green building codes and low-carbon urban planning. Qatar also plays a diplomatic role in global energy transition dialogues, hosting forums such as the Qatar Sustainability Week and contributing to the UNFCCC process. These efforts reflect a strategic pivot: using its hydrocarbon wealth to finance a future built on clean energy, innovation, and regional cooperation.

5.6. Bahrain

Bahrain is steadily advancing its renewable energy agenda as part of its broader commitment to sustainability and carbon neutrality. By 2025, the Kingdom aims to generate 5% of its electricity from renewable sources, with a long-term target of 20% by 2035. Solar energy is the cornerstone of Bahrain's strategy, leveraging its abundant sunlight through key projects such as the 5 MW Bapco Solar Plant in Sitra, the 3 MW Bahrain International Airport installation, and the 2 MW Riffa Views residential solar system. A larger 44 MW solar initiative is also underway, signaling a significant shift in the national energy mix.

To support this transition, Bahrain has introduced net metering policies, tax incentives for solar equipment, and financing programs through Tamkeen and national banks. Public infrastructure is being upgraded with rooftop solar systems on schools, parks, and government buildings. At the same time, the Bahrain World Trade Centre stands as a pioneering example of wind energy integration, supplying 15% of its power through embedded turbines. (Bahrain Solar News, 2025). The Sustainable Energy Authority is developing a renewable energy certificate system and exploring electric vehicle integration, further aligning Bahrain's energy landscape with global decarbonization trends. These efforts reflect Bahrain's strategic vision to reduce fossil fuel dependency, enhance energy efficiency, and foster a resilient, low-carbon economy.

6. ISLAMIC FINANCE AND RENEWABLE ENERGY

The rapid expansion of Islamic financial products and services over recent decades has played a vital role in advancing green investment. This growth is driven not only by Islamic values that emphasise environmental protection, but also by broader imperatives for economic growth and sustainable development. Rooted in principles of equity, shared prosperity, and justice, Islamic finance promotes fair access to resources so that all living beings may benefit from God's bounty. Islam prohibits such practices as excessive consumption, pollution, environmental degradation, and monopolistic control to ensure that natural resources remain accessible to all species. In other words, practices that deplete shared resources, damage ecosystems, or concentrate control in the hands of a few violate the Shariah compliance by undermining social justice, ecological balance, and the rights of future generations. By discouraging over-consumption, pollution, and monopolistic behavior, Islamic

ethics promotes a sustainable and equitable distribution of resources, ensuring that all creatures—human and non-human—can benefit from the resources of our planet Earth. Investment in Islamic finance is fundamentally human-centred, aiming to generate benefits that extend to the entire society. Moreover, because it must comply with Shariah principles, investment activity is required to follow strict ethical guidelines.

Islamic financial instruments—including *murābahah*, *ijārah*, *mushārakah*, and *sukūk*—provide flexible, asset-backed mechanisms capable of financing green projects while remaining fully compliant with Islamic law. Among these instruments, green *sukūk* have advanced as a particularly powerful tool for mobilising capital toward sustainable infrastructure. Countries across the Middle East and Southeast Asia have already issued green *sukūk* to finance solar parks, energy-efficient buildings, and low-carbon transportation systems, demonstrating the sector’s capacity to accelerate the renewable-energy transition. In GCC countries—where economic diversification and sustainability are national priorities—the synergy between Islamic banking and renewable energy is especially important. Islamic finance can help bridge funding gaps, attract global investors seeking ethical portfolios, and support national visions centred on green growth. As renewable technologies become increasingly cost-competitive, the role of Islamic banking in supporting environmental protection and green investments will continue to expand.

The ethical foundations of the Islamic financial system further reinforce its alignment with environmental protection. The concept of public interest (*maṣlahah*) and the objectives of Islamic law emphasise the protection of life, resources, and future generations. This creates a moral imperative for Islamic financial institutions to support initiatives that reduce pollution, conserve natural resources, and promote long-term ecological balance. Consequently, investments in the energy transition are not only financially viable within Islamic banking, but also deeply aligned with its core values.

The relationship between Islamic finance and the energy transition reflects a broader paradigm shift in contemporary development thinking. It moves beyond conventional growth models by embedding environmental protection and social justice into financial decision-making. Grounded in Shariah principles that emphasise equity, shared prosperity, and the ethical use of resources, Islamic finance provides a normative framework well suited to advancing sustainable energy systems. Through instruments such as green *sukūk*, profit-and-loss-sharing arrangements, and asset-backed structures, Islamic banking can facilitate large-scale investments in renewable energy while ensuring distributive fairness. This synergy positions Islamic finance as a transformative agent capable of shaping a more sustainable, equitable, and ethically coherent energy future (Al Roubaie & Sarea, 2019b).

Global *sukūk* issuance continued its upward trajectory in 2025, with total issuances rising by 12.7% to reach \$264.8 billion, according to S&P Global. The GCC region accounted for 45% of this global volume, driven primarily by Saudi Arabia and the UAE, the two leading issuers in the region. Globally, Saudi Arabia ranked second after Malaysia, issuing approximately \$72.5 billion, largely to finance development projects aligned with Vision 2030. The UAE followed with \$22.1 billion in issuances during the same year. Looking ahead, global *sukūk* issuance is projected to reach \$270–\$280 billion in 2026. Sustainable *sukūk* represented a growing segment of the market, amounting to \$21.1 billion in 2025, reflecting rising demand for green and environmentally focused investments across the GCC. Regional financial institutions, including the Islamic Development

Bank, remain central to the expansion of sustainable *sukūk*. (The Arab Today, January 26; Khaleej Times, January 28, 2026)

Recent analyses by Greenpeace MENA and the Global Ethical Finance Initiative (GEFI) highlight the significant—yet underutilised—potential of Islamic finance in accelerating the global transition to renewable energy. Their report, *Islamic Finance and Renewable Energy*, argues that the sector’s core principles—ethical investment, environmental stewardship, and social responsibility—naturally align with the objectives of sustainable energy development. By mobilising even a small share of its assets, Islamic finance could become a transformative force in closing the global climate-finance gap. The study emphasises that Islamic financial instruments such as *sukūk*, *muḍārabah*, and *wakālah* are well suited for long-term infrastructure investments, including solar, wind, and green-hydrogen projects. These instruments can attract both institutional and retail investors by offering transparent, asset-backed structures that avoid excessive uncertainty and speculation. (Greenpeace MENA, 2024)

Islamic finance currently manages approximately \$4.5 trillion in assets. According to the Greenpeace MENA report, allocating just 5% of these assets to renewable-energy projects could unlock \$400 billion in climate-aligned financing by 2030. As the report notes, “the mobilisation of Islamic finance for renewable energy not only yields significant benefits for Muslim countries but also contributes to global sustainability efforts to tackle the climate crisis. Islamic finance has the capacity to set a precedent for other ethical finance models and catalyse international collaboration in renewable energy initiatives. Furthermore, the report underscores the need for Islamic financial institutions to acknowledge the considerable investment potential within the renewable energy sector, which not only promises competitive financial returns but also generates positive social and environmental outcomes.” (Greenpeace MENA, 2024, P. 6). The report highlights Islamic finance as a strategic solution for countries aiming to expand clean energy initiatives, while adhering to Shariah-compliant investment frameworks. In addition to financing, it highlights the broader developmental benefits of aligning Islamic finance with renewable energy, including reducing pollution, enhancing energy security, supporting biodiversity, and enabling climate-resilient economic growth particularly in regions with large Muslim populations and high renewable - energy potential, such as the Middle East, North Africa, and Southeast Asia (Greenpeace MENA, 2025).

7. CONCLUSION

Building institutional and technical capacity for energy transition enables GCC countries to minimise the adverse effects of cyclical fluctuations in global energy prices. Their heavy dependence on international energy markets has exposed them to price volatility, which directly impacts government spending, employment levels, and household incomes. Strategic investment in clean energy can reduce economic vulnerability, stabilise national economies, and lay the foundation for long-term sustainable development.

Historically, economic development in GCC economies has been shaped by public sector employment and state-led investments, largely financed through fossil fuel revenues. As these revenues decline, it is imperative for GCC nations to diversify their energy sources, reduce dependency on global oil markets, and enhance economic resilience. Energy transition offers a viable pathway—not only by replacing finite resources but also by stimulating industrial growth, generating employment, and supporting inclusive development. It strengthens energy security by diversifying the energy mix and reducing exposure to external shocks.

The GCC remains among the most fossil fuel-dependent regions globally, with electricity generation still dominated by oil and gas. These fuels continue to finance infrastructure and public services, yet they contribute significantly to environmental degradation, biodiversity loss, and climate change—particularly through extraction, shipping, and transport activities. A successful strategy for sustainable development must prioritise energy efficiency, clean transition pathways, and the adoption of environmentally friendly technologies. This transformation will be driven by investments in solar, wind, and green and blue hydrogen.

Governments must enact forward-looking policies that support this shift, build capacity for intelligent energy systems, and promote the emergence of intelligent, sustainable societies. Human capital development, institutional reform, and digital infrastructure will be critical to scaling renewable energy and ensuring inclusive growth. Recent growth in Islamic banking services and products could strengthen GCC countries' initiatives to build capacity for a green economy, particularly through investments in clean and sustainable energy resources. The Islamic financial system is grounded in ethical principles that align with the teachings of Islam. These principles not only promote justice and the fair distribution of income and wealth, but also prohibit the excessive exploitation of natural resources and the mismanagement of the environment. In doing so, they help protect biodiversity and support long-term sustainability.

When renewable energy technologies are tailored to the Gulf's unique climate, infrastructure, and development priorities, they can significantly enhance climate resilience, reduce dependence on fossil fuels, and protect fragile ecosystems. Such deployment approach also supports long-term economic diversification by building local expertise, promoting knowledge localisation, stimulating green industries, and fostering innovation ecosystems. Through international collaboration and adaptive technology transfer, the Gulf can position itself as a global leader in sustainable energy while securing a more prosperous and environmentally-friendly future.

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