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In 2020, the world faced a substantial disruption due to the onset of the COVID-19 pandemic, resulting in an unprecedented 70% decline in global energy consumption during the initial months of the crisis. Consequently, the prices of numerous energy sources plummeted to their lowest levels in decades.

However, as global fuel prices began to recover in 2021, they surged once again in 2022 following Russia's military invasion of Ukraine, presenting a formidable challenge for policymakers. Specifically, prices, especially for natural gas, reached historically high levels due to concerns over potential disruptions in energy trade and future supply.

To delve deeper, Russia held a substantial position in global markets for natural gas, crude oil, and coal, accounting for approximately 20%, 10%, and 5% of global exports in those commodities, respectively. Furthermore, it was deeply integrated into Europe's markets and distribution networks, supplying 35%, 25%, and 45% of natural gas, crude oil, and coal imports for both the EU and the U.K. combined in 2020. By the conclusion of the first quarter of 2022, crude oil prices had doubled, coal prices had tripled, and natural gas prices had risen more than five-fold in comparison to early 2021.

Instead of giving precedence to social and environmental advantages, oil and gas firms found themselves working hard to present appealing sustainable development reports as a means to safeguard their reputation during challenging times. Consequently, researchers have increasingly concentrated on pinpointing deficiencies in the corporate reporting practices of these companies. Environmentalists and certain U.S. legislators criticized these actions, calling on companies to allocate more resources to support the transition to cleaner energy. Investors who collectively held a substantial \$2.3 trillion in equity within the global oil and gas sector began to revise their expectations regarding growth markets more rapidly than the executives of energy firms. Notably, approximately 75% of surveyed investors affirmed their commitment to retaining their shares with the aim of accelerating investments in technologies with lower carbon footprints.

In the ever-evolving global landscape of energy, characterized by environmental concerns, technological advancements, and the pursuit of cleaner energy sources, this report delves into the future prospects of the global gas market and its implications for Lebanon.

Nations across the globe are undergoing a significant shift towards adopting greener energy solutions. This transformation is primarily driven by a shared commitment to reducing carbon emissions, a paramount goal in the fight against climate change. Natural gas has emerged as a vital transitional fuel in this context, owing to its relatively lower carbon emissions compared to coal and oil. Indeed, governments worldwide are actively mobilizing both public and private investments to expedite this transition. As countries align themselves with the 2050 net-zero emission targets outlined in the Paris Agreement, there's a growing recognition of the necessity for embracing cleaner energy sources. Consequently, leading economies like the United States, China, and the European Union have witnessed substantial capital inflows due to high-level policy directives supporting clean energy initiatives. These investments are critical in

advancing the development and deployment of sustainable energy technologies.

The transition to clean energy holds a multitude of substantial economic advantages that extend beyond the immediate environmental benefits. First and foremost, it stimulates job creation and economic growth. Investing in renewable energy technologies, such as solar, wind, and hydropower, results in the establishment of new industries and the expansion of existing ones. These sectors are often more labor-intensive than traditional fossil fuel industries, generating numerous jobs in manufacturing, installation, operation, and maintenance. This job creation not only bolsters local economies but also strengthens a nation's global competitiveness.

Moreover, clean energy reduces energy costs in the long run. While there may be initial investments in renewable infrastructure, the ongoing operational costs are typically lower than those associated with fossil fuels. Renewable resources are abundant and essentially free, making the cost of energy production more predictable and stable. This stability is particularly attractive for businesses and households alike, as it mitigates the vulnerability to volatile fossil fuel prices. In addition, clean energy contributes to energy security by diversifying the energy mix, reducing reliance on imported fuels, and enhancing energy independence.

Furthermore, the clean energy sector fosters innovation and technological advancement. Research and development in renewable energy technologies result in breakthroughs that have broader applications beyond the energy sector. For instance, advancements in battery technology, driven by the demand for energy storage in renewables, are now revolutionizing electric vehicles and grid management systems. These innovations not only reduce greenhouse gas emissions but also position countries at the forefront of the global technological landscape, driving economic growth and export opportunities.

Additionally, transitioning to clean energy mitigates the economic risks associated with climate change. Extreme weather events, natural disasters, and rising sea levels can cause extensive damage to infrastructure, disrupt supply chains, and impact agriculture. By reducing greenhouse gas emissions and curbing global temperature rise, clean energy contributes to greater resilience in the face of climate-related economic shocks.

Therefore, the economic advantages of transitioning to clean energy encompass job creation, reduced energy costs, enhanced energy security, technological innovation, and resilience against climate-related economic risks. These benefits not only promote economic growth and stability but also position nations to thrive in a rapidly changing global energy landscape.

However, the transition to clean energy, while essential for a sustainable future, presents several significant challenges for countries. Firstly, one of the most substantial obstacles is the high upfront cost of renewable energy infrastructure. Building wind farms, solar arrays, and other clean energy projects requires substantial investments in both technology and infrastructure. These capital expenses can strain government budgets and require innovative financing solutions.

Secondly, intermittency and reliability issues associated with some renewable energy sources pose challenges. Solar and wind energy generation is weather-dependent and can fluctuate, which may necessitate backup power sources or substantial energy storage solutions to ensure a consistent energy supply. Grid upgrades and enhanced energy storage infrastructure are essential components of addressing this challenge.

Thirdly, transitioning away from fossil fuels can have a significant impact on regions and industries that rely heavily on traditional energy sources. This can lead to job displacement and economic disruptions. Addressing

the social and economic implications of this transition, such as retraining the workforce and revitalizing affected communities, is crucial.

Additionally, regulatory and policy hurdles can slow down clean energy adoption. Governments need to create a conducive policy environment that incentivizes renewable energy development and supports grid integration. Conflicting interests within the energy sector can also lead to resistance against clean energy policies.

Furthermore, securing a reliable supply chain for critical materials used in renewable technologies, such as rare earth metals for wind turbines and lithium for batteries, can be challenging. Overreliance on a few key suppliers or geopolitical tensions can disrupt supply chains. Lastly, public awareness and acceptance play a significant role. Some communities may resist the installation of renewable energy projects due to concerns about aesthetics, noise, or property values. Effective communication and community engagement are essential to address these challenges.

In summary, transitioning to clean energy involves overcoming financial, technical, regulatory, social, and supply chain challenges. These hurdles require comprehensive planning, collaboration among stakeholders, and innovative solutions to ensure a successful shift towards a sustainable energy future.

The momentum towards the clean energy economy is clearly accelerating. Some highlights in 2022 include the following:

- Electric vehicle sales surged by an impressive 55%, reaching an all-time high of over a million units. What's more, a significant milestone was achieved as, for the very first time, the manufacturing capacity for electric vehicle batteries has reached a point where it can effectively meet the anticipated demand requirements for the Net Zero Emissions by 2050 Scenario (NZE) by 2030. This indicates a crucial leap forward in the electrification of the transportation

sector, which is essential for reducing emissions and achieving climate goals.

- Nuclear capacity additions experienced a notable growth of 40%, with the installation of 8 gigawatts (GW) of new capacity. While the Net Zero Scenario necessitates substantial nuclear deployment, the growth observed in 2022 marks a significant advancement, particularly since capacity additions had previously remained relatively stable since 2019. This indicates a renewed focus on nuclear energy as a clean and reliable power source.
- Heat pumps continued their impressive growth trajectory, achieving a remarkable 31% increase in sales. This level of growth is closely aligned with the 15% average compound annual growth rate required to fully align with the Net Zero Emissions Scenario. Heat pumps play a vital role in enhancing energy efficiency in buildings and reducing carbon emissions, making them a pivotal technology in the transition to cleaner energy.
- Electrolyser installed capacity expanded by over 20%, while electrolyser manufacturing capacity increased by more than 25%. Electrolysers primarily serve the critical function of producing hydrogen gas, which is essential for various industrial processes, including ammonia production for fertilizers, as well as powering buses, trucks, and trains. Additionally, they offer an innovative energy storage solution by converting surplus electricity from renewable sources like wind, solar, and hydropower into hydrogen gas, which can be stored and utilized as needed, contributing to grid stability.
- The energy efficiency of the overall economy registered substantial growth, more than double the rate observed in the previous year. This positive development comes after a series of years with

relatively modest improvements in energy efficiency. Enhancing energy efficiency is crucial for reducing energy consumption, lowering greenhouse gas emissions, and optimizing resource utilization, making it a pivotal component of the transition towards a more sustainable and environmentally responsible energy landscape.

Progress is occurring faster in those parts of the energy system for which clean technologies are already available and costs are falling quickly, such as for electricity generation and passenger cars. However, a full transition to net-zero emissions will require decarbonizing all areas of energy production and use. Rapid innovation is needed to bring to market clean technologies in particular for those parts of the energy system where emissions are harder to address, such as heavy industry and long-distance transport. Positive steps forward on innovation have been made in the past few years, but acceleration is needed in order to soon move to deployment of novel low emission technologies for these areas.

The ongoing transition towards cleaner energy sources exhibits notable variations in its pace of progress, a divergence that spans different geographical regions and industry sectors. To illustrate, a striking 95% of electric car sales in 2022 were concentrated in China, the United States, and Europe. This concentration highlights the leadership of these regions in embracing electric mobility solutions. In contrast, approximately 75% of operational and planned carbon capture capacity is found in North America and Europe. This implies that a significant share of the global efforts to capture and store carbon dioxide emissions is concentrated in these regions. These carbon capture projects represent a critical strategy for mitigating climate change by preventing CO<sub>2</sub> from entering the atmosphere.

However, it is essential to note that while certain technologies may appear to be "on track" at a global level, this overarching assessment may not accurately reflect the progress of each nation. In some cases, specific countries may be making more rapid advancements in a particular technology, even if the technology is not universally adopted on a global scale. This highlights the nuanced nature of the transition to cleaner energy and the varying capacities and commitments of different countries. To ensure that progress in clean energy adoption is equitable and extends to emerging markets and developing economies, international cooperation and the formulation of robust policies play a crucial role. These efforts are pivotal for facilitating the exchange of knowledge and technology transfer, ultimately fostering a more balanced and sustainable global transition towards cleaner and more environmentally responsible energy solutions.

Technological innovation has been a driving force behind recent advancements in energy transitions. Indeed, the decreasing costs associated with solar and wind power, have significantly accelerated their adoption worldwide. Furthermore, notable progress has been achieved in enhancing energy efficiency, which has further propelled the momentum of the global shift towards cleaner and more sustainable energy sources.

In more details, solar energy has expanded exponentially across the world over the past 15 years, with capacity increasing more than 50-fold between 2008 and 2021. At the same time, the price of solar energy has dropped significantly. Indeed, 251 million households globally have solar panels on their roofs today and the number is expected to rise to 100 million by 2030. Solar systems help to lower greenhouse gas emissions by avoiding fossil fuel use, thus reducing air pollution.

In Lebanon, however, individual decisions to turn to solar are now more a response to the economic crisis rather than a reaction to climate change and air

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<sup>1</sup> BBC Future planet : How Solar power is keeping Lebanon' s lights on



pollution. In fact, since 2021, generators, typically owned by private providers, have operated as a nearly full-time substitute for electricity from the national grid, resulting in staggering electricity bills. Solar panels, on the other hand, ensure protection against blackouts and inflation of electricity bills. Indeed, between 2020 and 2022, the installed capacity of solar energy across the country multiplied more than eight-fold, largely from rooftop solar. Solar panels with a power of 777 MW were installed in 2021 and 2022, bringing Lebanon's total solar capacity to 869MW by end of 2022. As such, approximately 25% of the population in Lebanon utilizes solar energy systems.

Lebanon's position in the global gas market is influenced by both domestic and regional factors. Lebanon has expressed interest in exploring its offshore natural gas reserves in the Mediterranean Sea, which could offer a significant revenue source and reduce energy import dependence. However, Lebanon faces *infrastructure Challenges* as the development of the necessary infrastructure for gas exploration and production is complex and costly. Lebanon must invest in pipelines, processing facilities, and regulatory frameworks to establish a viable gas industry. Unfortunately, Lebanon faces *political and Security Concerns*, thus geopolitical instability in the region could pose substantial challenges to Lebanon's gas ambitions. Ongoing disputes over maritime boundaries and cross-border issues may impact the development of its gas sector. Finally, Lebanon's gas sector will be influenced by global gas prices and demand. Fluctuations in global gas prices could impact the economic feasibility of gas projects in Lebanon.

But on the good side, gas exploration and production will relieve the country from its high import bills. Besides, it will make available a cleaner source of energy, instead of relying on fossil fuel sources for the production and consumption of electricity. Interesting to note also, that the electricity crisis in Lebanon, especially over the past four years, have

encouraged the spread and use of solar energy that is increasingly being relied on as a sustainable, cheap, and clean energy source in the country.

**In conclusion**, the future of the global gas market is marked by a dynamic interplay of factors, including the transition to cleaner energy sources. The clean energy transition represents a profound economic opportunity with far-reaching benefits. While it addresses environmental challenges, it also drives economic growth, job creation, and energy security. However, challenges such as transition costs, policy consistency, and grid integration must be addressed strategically. The future of the clean energy transition is promising, marked by expanding global adoption and continued technological innovation, offering a sustainable and economically viable path forward. Lebanon's success in navigating these changes and capitalizing on its gas potential hinges on strategic investments, infrastructure development, and effective management of domestic and regional challenges. Adapting policies and market dynamics to align with the evolving global energy landscape is essential for a sustainable and resilient gas market in Lebanon and beyond.

Finally, the clean energy transition is expected to continue its global expansion. Emerging economies, in particular, are investing heavily in renewables to meet their growing energy demands while reducing emissions. Moreover, on-going technological innovation will further reduce the cost of clean energy technologies and enhance their efficiency, making them even more attractive.

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