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Saudi Arabia, Renewable Energy

### **Guaranteeing Saudi Arabia's Food Security through Investment in Renewable Energy**

Saudi Arabia is a beautiful nation with a rich culture and great potential, or a desert wasteland, depending on how one wishes to view it. It is a well-known kingdom in western Asia, with a large part comprising arid desert. It is also one of the most prominent Islamic countries on earth, with its religion shaping a significant portion of its government and culture. Along with other non-renewable sources, large amounts of oil are naturally found in the region. When one looks at a satellite image of Saudi Arabia, one may think that most of the country's area, taken up by sand, is unusable. As the world's population continues to increase, Saudi Arabia faces the same problems as other nations. The country's population is becoming too much for the resources available. Along with this, the era of fossil fuels, one of Saudi Arabia's main exports, has started to close. This ushers in a new era, a time of renewable energy. Moreover, while it may not seem like it, the empty Arabian desert may hold the answer to the problem. Despite significant wealth from the oil trade, Saudi Arabia remains at a crossroads in transitioning to a sustainable future. By capitalizing on its geography and solar potential, the Kingdom can overcome the challenges of non-renewable energy sources, focusing on sustainable development, economic diversification, and conservation. The development of the economy's agricultural production depends on a reliable energy source that can power the agricultural industry and provide the necessary funding to support the country's food imports.

The resources that countries have historically used are rapidly depleting. At one point, there was 120 cubic miles of water beneath Saudi, and now  $\frac{1}{4}$  of that amount has been used up -- a staggering amount (National Geographic). Demonstrating the burden placed on decreasing resources is the fact that the average family size in Saudi Arabia is about 6.4 people per household (Abdul Salam et al. 4). This number has declined slightly, but not enough to make a difference. On top of that, a significant portion of the country is young and, at some point, will bring into the world a family of their own. This bears bad news for the future of the Arabian Kingdom. Water will become even more scarce as temperatures continue to rise around the world, and because of this, it will become harder to grow crops and sustain agriculture in the desert. The typical Saudi family in Saudi Arabia has an average annual income of 143,796 SAR, around \$38k a year (CEIC). This is simply not enough to cover the rising costs of necessities such as food and water, as Saudi Arabia's economy faces a downward slump and the world becomes less reliant on crude oil. Saudi Arabia relies heavily on imports for food; those prospects seem to be slipping. Oil is being used less than new forms of energy. Saudi Arabia's food security is thereby threatened by a dire shortage of water that would render it impossible to sustain agricultural production and a potentially stagnating economy due to the global shift away from fossil fuels such as crude oil, upon which the Saudi Arabian economy is so heavily dependent. Desalinization is the most viable means of producing water to cater to its considerable agricultural needs. However, it is an energy-intensive process, thereby requiring the availability of tremendous amounts of energy that would guarantee Saudi Arabia's food security.

All of these factors combined present a bleak picture for the Kingdom. The country must learn to utilize the vast expanse of land within its borders to create energy for agriculture and other modern processes to keep the economy afloat. This is especially important, as people living in those extreme climates are more prone to outages or use a higher share of energy in a specific season. Saudi Arabia is undoubtedly an "extreme climate," with an average temperature during the summer months of 33.98° Celsius, or 93.2°

Fahrenheit. This is an additional climatological extremity to the lack of rainfall in the region (World Bank). The extremeness of Saudi Arabia's weather makes finding and using renewable energy sources vital to its survival. Its optimized land usage is imperative to ensure the country's continued economic viability, ensuring food security for its growing population. The optimization of land involves the construction of large plots of renewable energy sites that heavily exploit the country's sunny climate. Renewable energy in the form of solar power is a logical, sustainable energy path for Saudi Arabia to turn to. Renewable energy is energy from a source that will never be depleted, such as the sun or wind. The idea of renewable energy is becoming increasingly important worldwide, as governments look for ways to power their ever-growing economies without taxing the environment, like fossil fuels or other CO<sub>2</sub>-producing methods do. Wind and solar power are two prevalent forms of renewable energy. However, it is not always windy, and it is not always sunny. The problem thereby centers around energy conservation and utilization amid the obstacle of a lack of generation.

The energy sector plays a prominent role in this country's economy. It is one of the world's largest oil producers and produces kerosene, gasoline, and diesel; however, these are non-renewable forms of energy (The Royal Embassy). Saudi Arabia has an ample electricity supply thanks to the amount of natural gas the country possesses. This gas has been used for the petrochemical demand and has replaced direct oil burning; the residents do not have to worry about conserving electricity as its price is too low to worry about conservation (Alnatheer). According to The Royal Embassy, "The Kingdom also uses desalination plants to generate electricity using the steam that is a by-product of the desalination process" (The Royal Embassy). This natural gas presents an issue as there needs to be more incentive to investigate renewable resources for energy, especially since they come with higher capital costs. The challenge is that most of the costs are required initially, while the benefits are only seen long-term in the form of lower fuel costs, less environmental impact, and less maintenance. Another prominent player is banks, such as the World Bank, which make little effort to push for renewable and sustainable energy sources. The fact that there needs to be more knowledge among government officials and manufacturers also inhibits the push toward renewable energy (Alnatheer). One aspect of using non-renewable energy forms that people might need to be aware of is hidden costs. These may come in the form of respiratory complications, and the price of the medical bill goes uncovered by the price of the resource. For example, one might pay a certain amount for petrol and additionally pay for the respiratory complications caused by petrol emissions (Juth). However, there remain many consequential effects of using non-renewable resources for energy.

The search for truly perfect renewable energy continues, and whoever finds it first gains access to vast resources. There will be no shortage of power and no debating over the morality and consequence of how that power is farmed. Renewable energy supplies are also a great solution to weather events in extreme conditions. Many people live in temperate climates, but human ambition has brought us to even the most extreme corners of the globe. Clean and renewable energy is good for this, as they have "proven track records of both reducing peak demand and keeping the lights on during extreme conditions" (Massie and Schwartz). A deliberate and concerted effort is thus needed to fully exploit the benefits of renewable energy that would safeguard the food security of Saudi Arabia's growing population. Such an effort would not be difficult, especially as the country's climate and terrain primes it for renewable energy.

The desert provides a highly suitable area for solar panels and wind turbines to be placed. Saudi Arabia is near the equator, and its deserts receive a huge amount of sunlight— an average of 3600 hours a year. This is more than the mean amount globally, about 2330 hours per year (Akinde). Solar panels are a very effective means of providing energy, with an average efficiency of 20%. This means that 20% of the sunlight that hits the panels will be converted into energy. The government also owns most of the land in the desert, so building such technologies would not be complicated. There is also much space in the desert

for wind turbines, which would be very effective. ‘Shamals’, or periods of significant winds throughout the desert, occur twice yearly, from December to January and May to June. Winds during these periods may average up to 30mph (Holm et al.) Solar panels will be able to generate enough energy during summer, while the two windy periods during the year could supply even more power. This is a good solution to the problem of energy in Saudi Arabia. On top of that, wind and solar power actually work together to do something entirely different. These renewable energy sources can actually change the environment over larger scales. According to a study published in the 2018 edition of *Science*, wind and solar power can reduce albedo, which is the “ratio of reflected sunlight to received sunlight on the land surface” (Chen). A reduced albedo would change the direction of airflow and pressure, generating extra rainfall. Wind turbines alone can do the same thing as they change the air pressure and wind velocity.

Saudi Arabia has already begun to put some of these renewables into practice. The Kingdom established the National Renewable Energy Program (NREP) to fix the mentioned problems and advance the nation. Through the NREP, Saudi Arabia intends to transition to 50% renewable energy by 2030 (Iea). Saudi Arabia has already built wind and solar farms to harness these abundant resources. It has been able to provide power to 144,000 independent households through these renewable grids (Everill). This is part of the country’s Vision 2030 initiative, a “unique transformative economic and social reform blueprint that is opening Saudi Arabia up to the world” (Everill). Another aspect of this program is the green city NEOM, which is a new city being built in the northwestern part of the country that will be powered 100% by renewable energy. Saudi Arabia has also pioneered new forms of clean energy, including a special type of solar panel that produces water. This panel utilizes hydrogel, a device that can draw water vapor from the surrounding air. Hydrogels can lower the panel’s temperature and conserve excess energy when used in conjunction with a solar panel (Everill). These upgraded panels were found to have a 9% increase in efficiency compared to other normal panels. This is very good for the future of energy in Saudi Arabia, as it is a way to tackle multiple issues, such as energy consumption and water scarcity, at the same time. The clear advantage of renewable energy for the Saudi Arabian household is demonstrated. Being energy secure ensures a degree of economic security that would also play a role in a person’s food security. While wind and solar power can be implemented on a large scale and help to produce energy at a higher, more accessible rate, they also may bring extra water desperately needed by the desert communities of Saudi Arabia. This water can also be stored and used to generate even more power through hydroelectric procedures. Hence, there are potentially limitless possibilities for expanding agriculture, even in the Saudi Arabian desert, thereby guaranteeing Saudi Arabia’s food security.

Energy and food security form a crucial link for the viability of Saudi Arabia’s society and economy. Saudi Arabia has long been dependent on finite resources in terms of its energy and water supply and its economy, which is primarily reliant on crude oil exports. The depletion of its underground water reserves and the potential for its economy to be heavily stagnant, resulting in the loss of food security, is a looming threat to Saudi Arabia. However, if it fully exploits the abundance and cost benefits of natural energy resources, it will be able to remain the agricultural and economic powerhouse that it is. Its climate and terrain that provides it with abundant sunlight, a wind provider, is an unignorable feature in any consideration of moving to renewable energy.

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