

Nuclear Aramco: Transforming Saudi Arabia's Energy Landscape and Geopolitical Dynamics

Saudi Arabia's energy landscape and diversification strategy

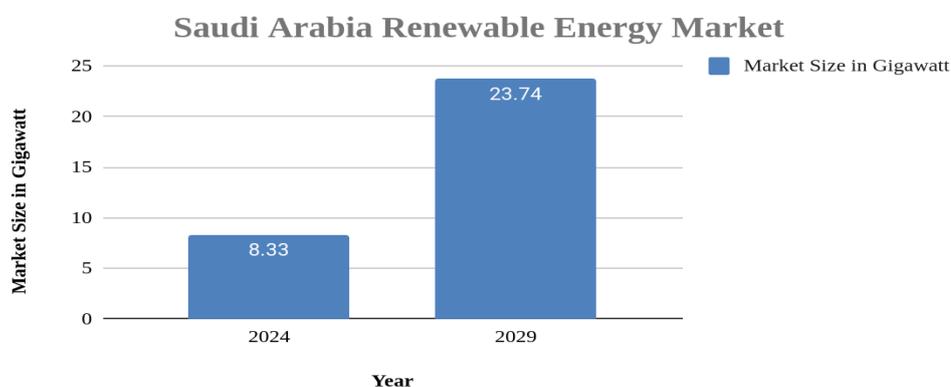
Saudi Arabia's economy depends on oil and gas production. As the world's biggest oil exporter, the industry accounts for nearly 50% of the country's GDP and foreign revenue. Although rich in oil, Saudi Arabia does confront environmental challenges from greenhouse gas emissions. Fluctuating oil prices and carbon emission regulations highlight the risks of fossil fuel dependence.

Saudi Aramco, Saudi Arabia's state-owned oil and gas company, is vital for the Kingdom's economy. As one of the world's largest oil producers and exporters, it drives Saudi Arabia's economic growth. Producing around 11.5 million barrels of oil per day and holding over 260 billion barrels, Aramco significantly contributes to the GDP and government revenues.

Innovative investments, collaborations, and technical developments by Aramco provide employment and boost developing industries in the Kingdom. Aramco's worldwide impact and strategic relevance make it a major middle east and global energy actor. Its actions affect global energy security and politics. As Saudi Arabia transforms its energy portfolio, Aramco's sustainable development role will affect its economy and geopolitics.

Aramco views renewable energy as crucial for sustainability and economic stability and has invested in solar and wind projects, leveraging the kingdom's renewable energy potential. It is also exploring carbon capture and storage (CCS) and hydrogen production to reduce carbon footprints and support a low-carbon economy.

To work in favour of its sustainable goals, the Aramco aims to source 50% of its energy from clean sources by 2030, showing its commitment to reducing carbon emissions and aligning with Vision 2030's goals of economic sustainability. The company's investments in large-scale solar and wind projects across Saudi Arabia illustrate its strategy to diversify energy sources. It also uses clean energy to power unconventional gas wells in the northwest, showcasing its commitment to renewable energy. Moreover, the renewable energy market for the Saudi Arabia is expected to grow from 8.33 % to 23.74% in next half decade.



Enter Nuclear Aramco

Last year, Riyadh proposed a project to the U.S. to establish Saudi Arabia's civilian nuclear energy program, commonly referred to as "Nuclear Aramco." This initiative aims to boost Saudi Arabia's atomic energy capabilities and address U.S. and international concerns about nuclear proliferation. Saudi officials proposed making Nuclear Aramco a commercial branch of Saudi Aramco, focusing on nuclear-enriched fuel. Inspired by Saudi Aramco's success in the oil industry, Nuclear Aramco aims to replicate this success in nuclear energy.[1]

The proposal aims to create an Arabian American Nuclear Power Co., involving U.S. companies in developing and supervising Saudi's nuclear power projects. The uranium enrichment will occur in Saudi Arabia under strict American oversight to ensure adherence to international non-proliferation standards. There are discussions about a potential U.S.-Saudi Arabia agreement for the transfer of sensitive nuclear technology and materials, pending Congress approval. This would allow American nuclear companies to enter the Saudi market while ensuring safeguards against military use.

With substantial uranium reserves[2][3], Saudi Arabia aims to meet its energy needs and become a key player in the global nuclear fuel market, potentially exporting enriched uranium to the U.S. However, negotiations face challenges. Riyadh wants to produce nuclear fuel domestically, conflicting with the U.S. preference for foreign sourcing to prevent weaponization. Riyadh's consideration of partnerships with China or Russia highlights the geopolitical stakes if U.S. cooperation falters.

Energy issues and nuclear cooperation have been central in recent talks between President Biden's National Security Advisor Jake Sullivan and Crown Prince Mohammed bin Salman, reflecting the complex dynamics of energy security and international relations.[1]

Maximising the Use of Uranium Reserves

Saudi officials have announced the discovery of significant uranium reserves in the Kingdom, estimated to be 1.4% to 5% of the world's supply. Energy Minister Prince Abdulaziz bin Salman announced plans to tap into these resources through joint ventures, adhering to international standards. With abundant uranium deposits, Saudi Arabia aims to strengthen its presence in the global nuclear fuel market, reducing reliance on fossil fuels.

At an energy conference [5], Prince Abdulaziz outlined plans to leverage uranium resources with global partners, ensuring transparency and compliance with international norms. Strategically focusing on uranium development offers Saudi Arabia a chance to meet its energy needs and become a key nuclear fuel exporter. By venturing into the nuclear fuel market, Saudi Arabia not only bolsters its energy independence but also solidifies its position in the global energy landscape. The development of uranium resources has the potential to attract substantial foreign investment and encourage technological partnerships, which can contribute to economic diversification. In addition, the possibility of Saudi Arabia becoming a nuclear fuel exporter has the potential to significantly impact geopolitical dynamics, especially in its interactions with major global players such as the United States.

Despite Saudi Arabia's claims of substantial uranium deposits, exploration and extraction face significant challenges. Some reports label these reserves as "inferred," requiring more exploration to confirm viability [4]. Chinese geologists highlight the economic difficulty due to hard granite and mixed metals. The latest Red Book data from the Nuclear Energy Agency and the International Atomic Energy Agency, supports this assessment. It shows that Saudi deposits are smaller than those in Botswana, Tanzania, and the United States.

Ensuring the Safe and Responsible Export of Enriched Nuclear Fuel

As Saudi Arabia plans to develop a domestic nuclear fuel industry, including uranium enrichment, ensuring the secure and responsible export of enriched nuclear fuel is crucial. To maintain its nuclear program's credibility and international trust, Saudi Arabia must establish strong verification mechanisms and comply with global nonproliferation standards.

Saudi Arabia has opted to revoke the Small Quantities Protocol (SQP) and adopt the complete Comprehensive Safeguards Agreement (CSA) with the International Atomic Energy Agency (IAEA). This reflects the Kingdom's commitment to openness and preparation for tighter IAEA monitoring and inspection, as well as its adherence to nuclear transparency.

Secondly, Saudi Arabia has yet to implement the Additional Protocol to its IAEA safeguards agreement, which would allow for greater access and inspections. Taking this step would strengthen international trust in the peaceful intentions of its nuclear program. The U.S. has emphasized the importance of Saudi Arabia signing and ratifying the Additional Protocol for nuclear cooperation.

The kingdom must implement a rigorous export control mechanism to prevent the misuse or unauthorised transfer of enriched nuclear fuel and associated materials for military purposes. This includes enforcing stringent licensing requirements, keeping comprehensive export records, and collaborating with global initiatives to combat nuclear smuggling and illicit trade.

By incorporating these verification mechanisms and following internationally recognized standards, Saudi Arabia can build trust with the global community and establish itself as a responsible exporter of enriched nuclear fuel.

Addressing the concerns of making a Nuclear Weapon-grade Stockpile

Creating a weaponizable stockpile of highly enriched uranium (HEU) is complex, as enrichment facilities for civilian reactors operate far below weapons-grade levels. Transitioning from low-enriched uranium (LEU) to HEU requires significant technological advancements and changes that are difficult to conceal. Advanced centrifuge technology is needed to achieve weapons-grade uranium, requiring expertise, precise engineering, and substantial financial investment. These activities are detectable by international monitoring agencies due to unique isotopic signatures and energy use patterns. Moreover, a secure and covert setup is essential. Redirecting civilian enrichment facilities for weapons production is unlikely to go unnoticed, given stringent international oversight designed to detect such activities.

To prevent enrichment facilities from being used for nuclear weapons, strong safeguards and oversight measures are crucial. The IAEA inspections track nuclear materials, monitor facilities, and conduct regular audits to ensure compliance with non-proliferation agreements. The proposed U.S.-Saudi nuclear cooperation framework emphasizes oversight to minimize proliferation risks. Enriching uranium in American facilities with strict U.S. oversight ensures sensitive nuclear activities remain controlled, reducing the risk of unauthorized use.

The U.S. supports high-quality non-proliferation provisions in any agreement with Saudi Arabia, including commitments to avoid domestic enrichment and reprocessing, relying on external suppliers for nuclear fuel. These measures limit Saudi Arabia's capacity to independently produce weaponizable materials. [14][15]

Saudi Arabia has committed to global non-proliferation norms and transparency, adhering to international and bilateral safeguards. This commitment to peaceful nuclear energy use addresses global security concerns. [14] By implementing strict oversight, strong agreements, and dedication to non-proliferation, Saudi Arabia can develop its nuclear energy sector responsibly and transparently, contributing to global energy security and minimizing proliferation risks.

Addressing Challenges and Strategies for Success

While promising, the Nuclear Aramco project faces obstacles that must be addressed for successful execution and long-term viability. Establishing a domestic nuclear fuel industry in Saudi Arabia involves technical and operational challenges.

Technical Challenges of Uranium Extraction and Processing: Saudi uranium deposits are found in dense granite and mixed with metals, making extraction and processing difficult. Advanced mining and refining technologies, along with specialized expertise within the Kingdom, are necessary to tackle these challenges.

Operational Efficiency and Safety: Operating nuclear facilities requires strict safety protocols and efficient practices to minimize risks and ensure a steady fuel supply. Saudi Arabia should implement strong safety protocols, thorough training programs, and advanced technologies to enhance nuclear operations.

Geopolitical and Security Concerns: Introducing nuclear energy in Saudi Arabia raises important geopolitical and security considerations that must be navigated carefully. The Kingdom's nuclear ambitions have sparked concerns among regional neighbors, especially Israel, which sees Middle Eastern nuclear capabilities as a security risk. Balancing regional relationships and considering neighboring countries' interests is vital for the success of Nuclear Aramco. Saudi remarks about acquiring nuclear weapons in response to Iran's actions have raised global concerns about nuclear proliferation[8][9]. It's crucial to adhere strictly to the Nuclear Non-Proliferation Treaty (NPT) and other regulatory frameworks to alleviate concerns and show Saudi Arabia's commitment to peaceful nuclear use.

Collaboration and Transparency: To address geopolitical and security challenges, Saudi Arabia must build strong international alliances and ensure transparency in its nuclear activities. Close cooperation with reliable partners like the United States and implementing strong safeguards and monitoring systems will be essential for fostering trust and managing security concerns.

By proactively addressing technical, operational, and geopolitical challenges, Saudi Arabia can establish Nuclear Aramco as a responsible, sustainable project that supports energy diversification while maintaining global nonproliferation norms and regional stability.

Framework for Nuclear Cooperation

Saudi Arabia's nuclear aspirations need a stable framework for international nuclear partnership to ensure safe and responsible nuclear energy development. Saudi Arabia seeks nuclear cooperation arrangements with the US, China, Russia, and South Korea. These agreements might involve uranium exploration, power plant building, and fuel cycle operations. [10][11][12]

One key aspect is establishing a uranium enrichment capability within Saudi Arabia. The Kingdom aims to develop a full nuclear fuel cycle, including yellowcake production, low-enriched uranium, and nuclear fuel for domestic use and export.[13] The international community is concerned about potential nuclear proliferation due to this ambition. To address proliferation concerns, the U.S. emphasizes strict non-proliferation standards and effective safeguards. The U.S. has urged Saudi Arabia to sign the Additional Protocol to its IAEA safeguards agreement, allowing more thorough inspections of its nuclear facilities.

The U.S. has consistently opposed the spread of fuel cycle technologies like uranium enrichment and plutonium reprocessing due to their dual-use potential. It seeks firm commitments from nations to avoid developing these sensitive technologies. The U.S. faces a delicate balance with Saudi Arabia, prioritizing non-proliferation norms while considering the Kingdom's interest in nuclear energy and fuel cycle capabilities.

Conclusion

Nuclear Aramco initiative represents a transformative step for Saudi Arabia's energy sector, aiming to diversify its energy sources, reduce reliance on fossil fuels, and contribute to global sustainability efforts. Leveraging its significant uranium reserves and strategic international partnerships, Saudi Arabia aspires to become a major player in the global nuclear fuel market. The project aligns with the ambitious goals of Vision 2030, promoting economic diversification, technological advancement, and environmental sustainability. The successful implementation of Nuclear Aramco will not only enhance Saudi Arabia's energy security and economic resilience but also position it as a leader in the global transition towards cleaner energy solutions.

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