



مركز الملك عبدالله للدراسات والبحوث البترولية
King Abdullah Petroleum Studies and Research Center

Commentary

The Saudi Nuclear Energy Project

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Noura Mansouri





Many international companies want to take part in Saudi Arabia's nuclear energy sector.

Establishing a nuclear sector in Saudi Arabia should result in lower unemployment and increase average wages.

Saudi Arabia's nuclear energy program has been a subject of intense speculation recently, especially since the establishment of the King Abdullah City for Atomic and Renewable Energy (KA-CARE) by Royal Order No. A/90 in 2010.

In 2012, the government announced a new planned energy mix, including 12 nuclear reactors. This created a lot of interest from and aggressive competition among international energy companies that wanted to take part in the reactors' development. These companies opened offices in the Kingdom and recruited locally to establish teams that could tender for this ambitious project. KA-CARE was clear that localization was a prerequisite for vendor selection.

The United Arab Emirates' (UAE's) model for creating nuclear power generation was quicker to establish and required less localization than Saudi Arabia's plan. The Kingdom requires the following prerequisites from vendors: (1) the fulfillment of minimum local-content requirements; (2) the employment of Saudi workers; and (3) cooperation in creating research and development (R&D) programs.

By 2015, Saudi Arabia had signed nuclear cooperation agreements with many countries, including Argentina, France, Russia, Japan, China and the United States (U.S.). However, its nuclear program was very vague in its early years.

Despite its growing diversification efforts, Saudi Arabia's economy remains heavily reliant on oil. The country's increasing electricity consumption means that less crude oil will be available for export, thereby reducing the government's income, most of which is derived from oil. Given the country's reliance on oil income, the volatility of oil prices underscores the importance of diversifying its economic base and energy mix. It is in this context that it is vital for Saudi Arabia to exploit both renewable and nuclear energy resources.

In addition, the growing concern of the international community over climate change and the environment has exerted more pressure on the Kingdom to reduce its use of oil. The United Nations' (U.N.) nationally determined contributions (NDCs) have focused on lowering greenhouse gas and carbon emissions to curb climate change and enable countries to transition toward sustainable development.

Establishing a nuclear sector in Saudi Arabia should result in lower unemployment and increase average wages. It should also help the country to meet its desalination needs.

Nuclear desalination makes sense for Saudi Arabia, as it falls far below the water poverty line, as defined by the U.N., at 2,000 cubic meters per capita. This explains why the country is the world's largest desalination market. Nuclear power could provide a sustainable solution to its desalination needs.

Saudi Vision 2030, the Kingdom's blueprint for economic and power diversification, was launched in 2016.

It seeks to diversify the country's economy, create an attractive investment environment, generate new job opportunities and develop Saudi Arabia's human capital. It maintains the importance of localization and targets 25%-30% localization in the nuclear sector.

This diversification comes despite the Kingdom being one of the largest producers and exporters of oil. It is crucial that the country diversify its energy mix to meet its increasing demand for electricity. Electricity demand from households has grown, particularly for use in cooling, with industrial and desalination demand also growing.

Two initiatives aligning with the objectives of Vision 2030, the King Salman Renewable Energy Initiative, and the National Atomic Energy Program which was launched in mid-2017, aim to use nuclear power in the energy mix to transition toward sustainable development.

These initiatives will allow the Kingdom to invest the proceeds from its valuable natural resources and highly competitive refining capability and maintain its oil exports to international markets. Saudi Arabia is seeking to diversify away from oil for much of its additional future energy needs because oil resources can be used to generate export revenue.

Alongside the National Atomic Energy Program, the government has also issued the National Policy for the Kingdom's Atomic Energy Program, the Nuclear Law, and the Law of Civil Liability for Nuclear Damage. It established the Nuclear and Radiological Regulatory Commission, an independent regulatory agency, to monitor the implementation of its nuclear energy program, ensure the program complies with relevant laws, the protection of humans and the environment, and ensure it maintains the highest operational safety standards. This forms the legal and institutional framework that will regulate the Kingdom's nuclear energy sector.

Saudi Arabia is determined to maintain its right to enrich uranium. It plans to extract uranium domestically as part of its nuclear power program and sees this as a step toward being self-sufficient in its production of nuclear fuel. Preliminary studies show that Saudi Arabia boasts an estimated 60,000 tonnes of uranium ore. The country has confirmed that it is conducting exploratory uranium mining studies nationally to fully utilize its mineral resources.

The Kingdom reiterated that its National Atomic Energy Program is in accord with all international treaties and conventions and best international practices, and adheres to the highest safety, security and transparency standards. It has complied with all international nuclear treaties and conventions to which it is party, and it has also concluded a number of important bilateral agreements with other states for cooperating on peaceful uses of nuclear energy.

In mid-2018, the Kingdom received the International Atomic Energy Agency's Integrated Nuclear Infrastructure Review (INIR) mission to ensure its nuclear program was executed efficiently and was integrated – drawing on the INIR's experience in the execution of the program and the assessment of progress achieved in preparing the infrastructure for nuclear energy in the Kingdom.

Saudi Arabia aims to use nuclear power in the energy mix to transition toward sustainable development.

Saudi Arabia's nuclear energy program will start with two reactors totaling 3-4 GW.

Saudi Arabia has long been an opponent of nuclear weapon proliferation in the Middle East. It signed the Nuclear Non-Proliferation Treaty and is a member of the coalition of countries behind the U.N.-driven proposal for a Middle East nuclear-weapon-free zone. However, it has stated clearly that it would reconsider its position if other hostile nations in the region obtained nuclear weapons. Saudi Arabia has repeatedly called upon the international community to take a more stringent and transparent stance against all threats to regional and international peace and security, particularly Iran.

In January 2019, Saudi Arabia confirmed that its nuclear energy program will start with two reactors totaling 3-4 gigawatts (GW). The government will assess the prospects of growing its nuclear power sector, based on its needs. HRH Prince Abdulaziz bin Salman later said in his first announcement as minister of energy in September 2019, "We will proceed cautiously... we are experimenting with two nuclear reactors."

Saudi Arabia confirmed that it had short-listed five vendors: (1) Westinghouse, (2) Rosatom, (3) the Korea Electric Power Corporation (KEPCO), (4) Électricité de France (EDF)/Orano and (5) the China National Nuclear Corporation (CNNC).

1. Westinghouse

For decades, Saudi Arabia has been the strategic partner of the U.S. in the Middle East. The Saudi-U.S. relationship is solid, strengthened by trade, including the export of oil and the purchase of arms, and security provisions.

The U.S. maintains that, in order to receive its nuclear technology, Saudi Arabia must follow the gold standard, its non-proliferation guidelines, including foregoing enrichment and sign the Section 123 Agreement of the U.S. Atomic Energy Act (1954) – a nuclear cooperation agreement which the U.S. requires the recipients of its nuclear technology to sign.

However, in 2005 the U.S. made an exception for India for geopolitical reasons to counter China. With the rise of Russia and its eagerness to increase its footprint in the Middle East, especially after Egypt has inked a deal with Rosatom, which may weaken the U.S.' presence, and with Westinghouse filing for bankruptcy, the U.S. might also make an exception for Saudi Arabia in order to secure a deal.

The rise of shale production in the U.S. has been a game changer. The oil that used to be exported to the U.S. from Saudi Arabia now goes to Asian markets. This strengthens the Kingdom's diplomatic partnership with countries in Asia. Whether this weakens its partnership with the West remains to be seen.

U.S. President Donald Trump has repeatedly mentioned the US\$450 billion arms deal he hopes to conclude with Saudi Arabia. So the Trump administration may relax the U.S. 'gold standard' nonproliferation guidelines, which would otherwise prohibit Saudi Arabia from enriching uranium or processing spent fuel.

The U.S. is believed to be a key provider of nuclear technology to Saudi Arabia and will likely be part of its nuclear power program.

2. Rosatom

Egypt's US\$60 billion deal with Rosatom to build the El Dabaa 4.8 GW nuclear plant is one of the largest nuclear energy deals this century, and the financing model of this contract is the first of its kind in the nuclear industry. The US\$60 billion cost of the nuclear power plant covers its maintenance and the supply of nuclear fuel, with the reactors themselves costing about US\$29 billion. The nuclear plant will be built with a loan from Russia of up to US\$25 billion at an annual interest rate of 3%, paid back over 35 years. Egypt will provide the remaining 15% of the cost in cash.

Jordan also agreed a deal with Rosatom, but the project was eventually cancelled.

Russia, which has historically been a rival to the U.S. in the Middle East, is eager to increase its footprint in the region and does not require any restrictions of nuclear enrichment from Saudi Arabia. Russia may offer a similar financing strategy to Saudi Arabia, which is a value proposition not to be ignored, especially with low oil prices.

3. KEPCO

In 1987, KEPCO embarked on an effort to establish a standard design in Korea for nuclear power plants. It selected the System 80 design from the U.S. firm Combustion Engineering, which was later bought by Westinghouse in 2000. As the Korean reactor incorporates a U.S. design, any deal with KEPCO would also require Saudi Arabia to sign the 123 Agreement. South Korea joined the nuclear exporting vendors club when it sold reactors to the UAE to create the Baraka plant. The UAE signed the 123 Agreement with a clause that the agreement would be reviewed if Saudi Arabia got Westinghouse/KEPCO reactors without having to sign it.

The Saudi-South Korean relationship is booming, and oil trade is likely to remain the backbone of their economic relationship. Saudi Arabia remains the largest crude oil supplier to South Korea, especially after the U.S. sanctions on Iran in 2019.

Saudi Arabia and South Korea signed a memorandum of understanding (MOU) to launch a feasibility study to assess the possibility of building two small reactors in Saudi Arabia. In 2018, KEPCO and KA-CARE began economic feasibility studies on using KEPCO's reactor technology in Saudi Arabia.

4. Areva (EDF/Orano)

The French nuclear sector is undergoing many challenges, which is not uncommon in the nuclear industry. Of their three reactors currently under construction, only one project has succeeded: the Taishan nuclear power plant in China, Taishan 1, the first of two European Pressurized

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The choice of vendor for Saudi Arabia's nuclear energy program will determine its diplomatic relationship with the vendor country.

Reactors (EPRs), went online in August 2018. The other two nuclear power plants are years behind schedule and billions of dollars over budget. The EPR was developed by the French state-owned nuclear energy company Areva. Areva's first EPR export deal was with Finland for 3 billion euros, for use in the Olkiluoto plant. Olkiluoto has been under construction for 19 years. The delays in its construction tripled its original cost, the burden of which fell on Areva. The French national project, the Flamanville nuclear plant, is also over budget and behind schedule. Both Olkiluoto and Flamanville are expected to be completed by the end of 2019. However, after Areva accrued a loss of 5 billion euros, the French government made the decision in 2015 for EDF to take over Areva's reactor business. The operations of Areva, now Orano, were pared back to its fuel cycle business – uranium mining, conversion, enrichment, fabrication, reprocessing and the disposal of nuclear waste.

France is a strategic ally of Saudi Arabia. The two countries share a solid military and economic partnership, as well as partnerships in energy and industry. France is the third-biggest investor in Saudi Arabia, and is the third-largest arms supplier to Saudi Arabia (after the U.S. and the United Kingdom). The latest arms deals signed between the two countries amounted to US\$12 billion. They share the same political stance on Syria and Iran (unlike Russia). France would need Saudi Arabia to sign a prerequisite agreement before engaging in any nuclear power business with the Kingdom.

5. CNNC

China plays a pragmatic and balancing game among the region's rivals, seeking to expand its cooperation with countries in the Middle East. Saudi Arabia has been China's top crude oil supplier for almost 10 years. The Kingdom remains China's top oil supplier, especially after the U.S. sanctions on Iran in 2019.

Saudi Aramco has established close partnerships with Chinese oil firms. In 2003 it started working with state-owned Sinopec to explore gas fields in the Rub' al Khali desert. Saudi Aramco has also invested in Sinopec's petrochemical project in China, and the two companies have also established a joint venture to create the Yasref Yanbu refinery.

China's nuclear project developer CNNC has signed an MOU with the Saudi Geological Survey to explore and assess uranium and thorium resources. Saudi Taqnia signed an MOU with CNNC to develop water desalination projects using gas-cooled nuclear reactors.

In conclusion, assuming that all reactors are of the same level of passive safety and technology – a design approach that does not require any active intervention on the part of the operator or electronic feedback in order to bring the reactor to a safe shutdown state – it is less important which vendor Saudi Arabia chooses for its first two nuclear reactors. The choice will determine the importance of maintaining a strong diplomatic bilateral relationship with the vendor country over the coming decades. The real challenge for the Kingdom will be in establishing a nuclear sector built on a solid institutional infrastructure, a powerful legal and regulatory system, a strong industrial base, and advanced human capital.

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