

Can SMRs Rescue Jordan's Nuclear Program?

Ali Ahmad, of Princeton University's Program on Science and Global Security, recently returned from Jordan where he spoke to policy makers and officials from the Jordan Atomic Energy Commission about their interest in small modular reactors. He questions whether that choice is realistic.

Ask anyone in the Jordan Atomic Energy Commission (JAEC) why Jordan should invest in nuclear power, and you will be given a lecture on the need to achieve “energy security.” And, of course, the JAEC argues that nuclear power could give Jordan what it terms “energy security.”

But carry on the discussion a bit further and you will realize that there are still major obstacles to Jordan's ambitions of building the country's first nuclear reactor, despite advancing plans to import a Russian light-water reactor. Unlike other countries in the Middle East that are embarking on nuclear projects or entertaining the idea, such as the UAE and Saudi Arabia, Jordan's financial constraints are quite severe. An investment of the order of \$10 billion is required to build Jordan's first reactor and this constitutes about a third of the kingdom's GDP. Even if Jordan were to cover half of the bill, such an investment would strain the kingdom's slim budget.

Additionally, Jordan's electricity grid is quite small (about 3.4 gigawatts) and the integration of a large-capacity addition delivered by a large reactor would pose serious technical challenges. The response of JAEC officials to this challenge is the claim that by 2020 and beyond, when they expect Jordan's first reactor to start generating electricity, the size of the grid will be larger and that existing grid connections with neighboring regions in Egypt, Syria and Palestine would suffice to deal with the impact of shutting down the reactor for maintenance. Regardless of the credibility of these assertions, such a significant capacity addition to the grid would require a grid upgrade expected to cost around \$500 million.

During a recent visit to Jordan, I also found many JAEC officials advocating small modular reactors (SMRs) as a solution to some of the major challenges to deploying large reactors in Jordan. Indeed, on paper SMRs could overcome some of these obstacles. Their relatively small power output offers better compatibility with the size of Jordan's grid. More importantly, SMRs require lower initial investment than large reactors, which would help ease constraints on Jordan's treasury. Looking at it from these vantage points, Jordan might serve as a textbook case for SMRs. It should be noted, however, that the majority of the SMR designs, including those that excite the JAEC leadership, are still in the development phase and are not really an existing option.

While the concept of SMRs may be appealing to Jordan, they would not be the silver bullet that would solve the country's energy problems overnight, and sever-

al challenges to their development remain. Proponents claim that SMRs hold the solution to the four major problems of nuclear power: cost, safety, waste and proliferation. A recent Princeton University study by M.V. Ramana and Zia Mian challenging that claim pointed out that current SMRs concepts are, at best, designed to deal with one or two of the major issues at the expense of other issues. For example, the “price” for accruing the safety benefits that come with lower SMR power levels is the loss of economies of scale. There is a reason why existing power reactors are much larger than their early prototypes: smaller reactors are typically more expensive on a per unit cost basis. This means that on a per kilowatt basis, SMRs are more expensive to build and run than large reactors.

Because SMRs provide much less electricity compared to large reactors, Jordan would have to build many SMRs to meet growing electricity demand. JAEC's officials envision that these SMRs would be deployed in different sites across the Kingdom. What this implies is that the JAEC would have to overcome a series of deployment-related challenges at each site. Further, such a scenario not only would increase the already high capital and operating costs but also increase the vulnerability to security threats.

But the question of whether SMRs are a wise choice for Jordan begs a far larger question — namely whether Jordan, as a newcomer to the field, is ready to acquire nuclear power. Most importantly, there are serious questions about the competence and authority of the nuclear regulator, particularly given the recent merger of the Jordan Nuclear Regulatory Commission with the Electricity Regulatory Commission and the Natural Resources Authority, over which the International Atomic Energy Agency has expressed concern (related). Beyond that, though, there are other questions about Jordan's internal political dynamics and how they are affecting the nascent nuclear program. For example, take the choice of a site for Jordan's first nuclear reactor. After a national site selection committee evaluated a number of sites against IAEA criteria and chose a site near Al-Aqaba, the JAEC switched to another site in Al-Samra, which initially had been ruled out.

This is not the only example of interference by the JAEC with the regulatory and monitoring activities of Jordan's nuclear regulator — such intrusion led to the sacking of the former head of JNRC and the resignation of his deputy. These developments do not point to a promising start for Jordan's nuclear program or a solid base for importing reactors, whether SMRs or large reactors.