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# Nuclear Energy in the Middle East

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*The James Martin Center for Nonproliferation Studies, the National Defense University, and the Institute for National Security Studies held a two-day nonproliferation dialogue in Israel, April 29–30, 2018. The purpose of the dialogue was to exchange views on evolving threat perceptions, perceived gaps in goals, priorities, and policies, and identify further opportunities for deepening US–Israel cooperation in countering the proliferation of WMD and related threats. The following policy memo is based on the author’s presentation delivered during the dialogue.*

Many countries in the Middle East have expressed interest in pursuing nuclear-energy programs. Of these, six have developed concrete plans to materialize their programs: Egypt, Iran, Jordan, Saudi Arabia, Turkey, and the United Arab Emirates (UAE).

**To address non-proliferation concerns related to nuclear power in the region, programs should be judged based on their commensurability—a match between the country’s overall economic demands, timely fuel needs of its nuclear-power program, and its nuclear-fuel activities.**

Growing interest in nuclear power in the Middle East is largely attributed to two objectives: meeting the electricity demand of growing populations and economies, and seeking to enhance energy security by reducing reliance on fossil-fuel resources. Because of the inherent proliferation risk of nuclear energy—specifically its fuel-cycle infrastructure—it is important to examine the validity of these two motivations.

### Meeting Growing Electricity Demand

Annual electricity consumption per capita has been found to correlate with the United Nations

Human Development Index (HDI), a measure of human well-being reflected in life expectancy, literacy, education, and the standard of living.<sup>1</sup> When correlating with the annual consumption of electricity per person, HDI plateau is at about annual consumption of 4,000 kilowatt-hours (kWh) per person. This consumption level is also the approximate border line between developed and developing countries.

The following table shows the 2017 HDI score and annual electricity consumption per person in the six Middle East countries with nuclear-power programs and three other states, for comparison.

Country	HDI <sup>2</sup>	kWh/year person <sup>3</sup>
UAE	0.86	11,200
Saudi Arabia	0.85	9,400
Iran	0.79	3,000
Turkey	0.79	2,900
Jordan	0.73	1,900
Egypt	0.69	1,600
USA	0.92	13,000
Israel	0.90	6,600
China	0.75	4,000

The data validates the need for additional electricity production capacity in Egypt, Jordan, Turkey, and Iran, in that order of priority.

*The views and opinions expressed in this paper are those of the author and do not necessarily reflect the official policy or position of the James Martin Center for Nonproliferation Studies or the US government.*

## Enhancing Energy Security by Reducing Reliance on Fossil Fuel Resources

States in the Middle East often justify their nuclear-power programs as a means to increase energy security by reducing reliance on fossil fuels. It is important to note, however, that this logic is not as convincing for Saudi Arabia, Iran, and the UAE, which are among the ten richest in oil and gas reserves. The energy-security motivation for nuclear power is more valid for Turkey and Jordan, and only marginally so for Egypt, which has considerable gas reserves.

There are two additional factors that diminish nuclear energy's attractiveness: the high electricity costs compared to other power-production alternatives (especially in Iran, Saudi Arabia, and the UAE) and concerns related to nuclear safety and security. These latter concerns are particularly acute under the region's prevailing insecurity conditions. Both factors cast further doubt over regional states' motivations in pursuing nuclear power.

### Iran as a Prime Mover

Economic and energy needs alone cannot justify Iran's nuclear program. Iran was the world's third largest exporter of crude oil in 2011 (when sanctions were imposed on it due to its nuclear program) and has the second largest reserves of natural gas.<sup>4</sup> Its nuclear program began under Shah Mohammad Reza Pahlavi, who declared in 1974 that "sooner than believed, Iran will be in possession of nuclear weapons."<sup>5</sup> He later denied this declaration, but established a nuclear-power program nonetheless, which he perceived as a symbol of progress and power.

The Islamic Revolution of 1979 shut down the nuclear project. The new theocratic regime in Tehran perceived its predecessor's program as "nuclear junk from the West."<sup>6</sup> In 1984, however, Iran established a covert nuclear program, which included procuring enrichment technology, hardware, and some weaponization expertise from the Pakistani A.Q. Khan network. This change in Iran's nuclear policy initiated in the early 1980s during the Iran-Iraq War, after Saddam Hussein used chemical weapons against

Iranian forces and attacked Iran in "the War of the Cities," the protracted Iraqi campaign of strategic air raids and missile attacks on major Iranian population centers.

A group of Iranian dissidents revealed two undeclared nuclear sites in Iran at the end of 2002. Since then, the International Atomic Energy Agency (IAEA) uncovered a major undeclared nuclear program in Iran, including weaponization activities, which were later referred to as "possible military dimensions." Israel's 2018 seizure of tens of thousands of documents detailing Iran's nuclear-weapons-related activities further proved the existence of such a program. Tehran has categorically denied having any nuclear-weapons program, claiming that its nuclear program is for peaceful energy and research purposes only. Still, detailed intelligence information and Iran's historic attempts at concealing their nuclear activities from the IAEA have convinced the United States, Israel, and many other nations that Iran's nuclear-power program is a cover for fuel-cycle facilities suited for military use.

There are five basic facts that clearly demonstrate uranium enrichment for peaceful purposes in Iran is neither necessary nor economic:

1. The sole nuclear-power plant in Iran, the Bushehr reactor, must be fueled with Russian fuel based on the supplier contract between Russia and Iran;
2. It is not economically viable to operate an enrichment plant serving a nuclear-power program that produces less than ~25,000 megawatts of electrical output (a minimum of 15–20 nuclear-power plants);
3. There is a huge global surplus of enrichment capacity—as an indication, the price per separative work unit for uranium enrichment has been steadily dropping since 2010, from ~\$160 to ~\$40 in 2018;
4. The International Nuclear Fuel Bank in Kazakhstan initiated and backed by the Nuclear Threat Initiative was established under IAEA management to ensure supply of enriched uranium for countries that need a backup source to fuel their nuclear reactors; and

5. The supply of enriched uranium can be further ensured by buying equity in French and Russian enrichment companies.

Like Iran's, Saudi Arabia's nuclear-power program similarly lacks an economic or energy-security rationale, and can be better understood in the context of its rivalry with the Islamic Republic. One of the main reasons Saudi Arabia is insisting on its right to enrich uranium for its domestic nuclear program is to achieve parity with Iran, which is allowed to enrich uranium under the terms of the Joint Comprehensive Plan of Action (JCPOA), with the possibility of expanding those capabilities after 2025. Saudi unwillingness to forgo the right to enrich domestically (as was agreed by the United Arab Emirates) and Crown Prince Mohammed bin Salman's declarations that Saudi Arabia will develop nuclear weapons if Iran chooses to do so provide clear indications that Saudi Arabia intends to pursue a nuclear hedging strategy. Regional prestige may also play an important role in the Kingdom's rationale.

### A Way Ahead

Under the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), a country can enrich uranium with no restraints as long as these activities are under IAEA safeguards. A country is not constrained in expanding these capabilities. There is no requirement to ascertain that such activities are economical or practically needed in a timely manner for peaceful purposes.

Under the JCPOA, parties "will ensure that Iran's nuclear programme will be *exclusively* peaceful." Furthermore, Iran has agreed that any ultimate resumption of an "exclusively peaceful, indigenous nuclear programme" will be conducted "in line with scientific and economic considerations in accordance with the JCPOA" and will evolve "at a reasonable pace."<sup>7</sup> But there are no specific measures in the JCPOA to ascertain these requirements.

In the event that the JCPOA survives the US withdrawal, a possible way to address the proliferation risks associated with enrichment in

Iran is to agree on finding ways to delay the implementation of the so-called sunset clauses—restrictions to be eased on Iran's enrichment capabilities in years 10 and 15 of the agreement. One way to do so is to agree that Iran will have to keep the JCPOA's cap of 300 kilograms of uranium enriched up to 3.67 percent—as long as there is no concrete and timely need for enriched uranium to fuel its nuclear-power reactors.

Maintaining the present cap—and thus ensuring the peaceful purpose of Iran's nuclear program—will require the parties to agree on two conditions, which are valid whether the JCPOA remains in force or not. These necessary conditions are:

1. commensurability, i.e., Iran's enrichment capabilities should fit its overall nuclear power program's economic demands and timely needs;
2. establishment of a suppliers' norm that, at a minimum, conditions nuclear reactor sales on a lifetime fresh fuel supply and spent fuel take back exclusively by or through the supplier.

The first condition will cap Iran's enrichment at JCPOA initial levels until it operates at least 15–20 nuclear-power reactors. The second condition, (which is included in principle in the Russian model of "Build Own and Operate" projects for example) cancels any economic or energy-need argument for enriching uranium and reprocessing spent fuel domestically. Implementation of the second condition will further support the first condition, making all arguments about timeliness or economic demand irrelevant.

Applying these two conditions in Iran and elsewhere in the Middle East will allow peaceful nuclear-energy programs in the region to thrive while enhancing the regional nonproliferation regime and removing many of the proliferation risks associated with nuclear-power programs.

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- <sup>1</sup> For additional information, see United Nations Development Programme, Human Development Index (HDI), <http://hdr.undp.org/en/content/human-development-index-hdi>
- <sup>2</sup> Based on the UNDP, Human Development Indices and Indicators 2018, Statistical Update, [http://hdr.undp.org/sites/default/files/2018\\_human\\_development\\_statistical\\_update.pdf](http://hdr.undp.org/sites/default/files/2018_human_development_statistical_update.pdf)
- <sup>3</sup> Based on the World Bank World Development Indicators, <http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.USE.ELEC.KH.PC&country=#>
- <sup>4</sup> OPEC 2014 and 2017 Annual Statistical Bulletins, [https://www.opec.org/opec\\_web/static\\_files\\_proj](https://www.opec.org/opec_web/static_files_proj)

- [ect/media/downloads/publications/ASB2014.pdf](#) and [https://www.opec.org/opec\\_web/static\\_files\\_project/media/downloads/publications/ASB2017\\_13062017.pdf](https://www.opec.org/opec_web/static_files_project/media/downloads/publications/ASB2017_13062017.pdf)
- <sup>5</sup> See Abbas Milani, “The Shah’s Atomic Dreams,” *Foreign Policy*, December 29, 2010, <https://foreignpolicy.com/2010/12/29/the-shahs-atomic-dreams/>
- <sup>6</sup> Zack Beauchamp, “Why does Iran even have a nuclear program in the first place?,” *Vox*, Jul 23, 2015, <https://www.vox.com/2015/7/20/9002905/why-iran-nuclear-program>
- <sup>7</sup> Joint Comprehensive Plan of Action, Vienna, July 14, 2015, Preface, paragraph 1, emphasis added.