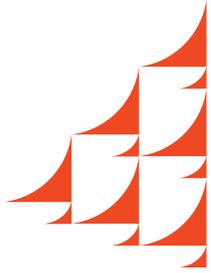


The Arab Gulf States
Institute in Washington
Building bridges of understanding



Civil Nuclear Energy in the Middle East: Demand, Parity, and Risk

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Executive Summary

Civil nuclear programs look set to become a feature of the energy landscape in the Middle East as states seek to balance growing domestic energy demands with a diversification away from fossil fuels. This paper studies the security policy implications of more civil nuclear installations being built and operated in the region and assesses the prospects for indigenous nuclear industries and relationships with international suppliers, with specific reference to the United Arab Emirates, Saudi Arabia, and Egypt. It concludes with recommendations aimed at enhancing international nonproliferation norms and controlling safety and security risks. The paper draws on dependency theory and realist assumptions, such as threat perception and alliance choices.

Introduction

It is surprising in a region that has recently experienced the Arab uprisings and conflicts in Libya, Syria, and Yemen, that the Middle East is still rushing to develop civil nuclear power projects that are susceptible to a host of associated risks. However, many Middle East and North African states are doing just that, including: the United Arab Emirates, Saudi Arabia, Jordan, and Egypt. Some are thinking about it: Morocco, Tunisia, and Algeria; while other states have cancelled their civil nuclear plans following the Tohoku earthquake, tsunami, and meltdown at the Fukushima reactor in Japan in 2011: Kuwait, Oman, and Qatar.¹ Indeed, former Japanese Prime Minister Junichiro Koizumi said in an August 2018 interview that he had been “deceived” about nuclear safety, costs, and cleanliness by nuclear supporters during his tenure.²

From the list of “aspirant” states, this study includes the UAE, Saudi Arabia, and Egypt. They are at different stages of their civil nuclear program development and bring to the fore the main political, energy, economic, and security issues involved in choosing civil nuclear energy and the risks associated with this option. The research questions in this paper aim to account for: first, why these states are pursuing nuclear power instead of other energy options; second, whether there are any risks in civil nuclear power challenging international nonproliferation norms; third, even if there is no link to nuclear proliferation, do these civil programs pose significant safety or security risks?

Although there is cogent economic rationale in many cases for the pursuit of a civil nuclear program, it can mask a multitude of other motivations, such as prestige, parity with other states in energy and security terms, and breakout potential with other states to affect change in the regional balance of power. Any nuclear ambiguity could support aspirations to (re)gain competitive advantage in the regional balance of power. Therefore, strict nonproliferation norms must be adhered to at all times and in all cases. So far, this appears to have been managed well in the case of the UAE. The paper highlights the range of nuclear safety concerns

¹ Carole Nakhle, “[Nuclear Energy’s Future in the Middle East and North Africa](#),” *Carnegie Middle East Center*, January 28, 2016.

² Robin Harding, “[Junichiro Koizumi: I’m Not Strange, I’m Extraordinary](#),” *Financial Times*, August 10, 2018.

and risks that exist with specific reference to the Middle East. All the cases highlight the necessity for continued investment in human resources, institutions, and laws that support the safe rollout of civil nuclear power programs.

Background on State Energy Mixes

There is a broad range of academic and policy-related literature surrounding the energy mix of states, including those in the Middle East. Anthony Cordesman and Khalid Al-Rodhan explain that international energy spikes show just how important Middle East energy is to the global economy.³ Gawdat Bahgat states that diversification of the energy mix at the global level is usually connected to: superiority of performance; energy density; how clean it is (especially considering the climate change debate and following various international agreements, such as the Kyoto Protocol and Paris Climate Agreement); how flexible it is; and ease of storage and transportation.⁴ Furthermore, he and others, such as Odysseas Christou and Constantinos Adamides,⁵ place the multifaceted issue of energy security at the forefront of political calculations on nuclear energy.⁶

Once an exporter of oil and gas, Egypt is struggling to meet its energy needs.

Laura El-Katiri cites energy use and energy conservation rather than any significant lack of hydrocarbon resources (in other words distributive problems) as important reasons why net exporters of oil and gas such as Egypt are experiencing energy poverty.⁷ Once an exporter of oil and gas, Egypt is struggling to meet its energy needs. Ninety-five percent of Egypt's energy needs are met through the use of oil and gas, which could be sold on the international market for hard currency. Various scholars note that the transition from oil to clean and renewable energies carries with it geopolitical risk. David Rothkopf states that changes in the global energy mix will bring with it more instability and new types of conflict.⁸ Kirsten Westphal and Susanne Droege agree that the changing global energy mix will bring with it more insecurity.⁹ Sergey Paltsev notes that the supply and demand for energy will continue to dictate the global

³ Anthony H. Cordesman and Khalid R. Al-Rodhan, *The Changing Dynamics of Energy in the Middle East, Volumes 1 and 2* (Westport: Praeger Security International, 2006).

⁴ Gawdat Bahgat, "Introduction," in *Energy Security: An Interdisciplinary Approach* (Chichester: Wiley and Sons, 2011), 3.

⁵ Odysseas Christou and Constantinos Adamides, "Energy Securitization and Desecuritization in the New Middle East," *Security Dialogue* 44, no. 5-6 (2013): 507-22.

⁶ Bahgat illustrates energy security dimensions as being long term and short term, geopolitical, economic, reliability related, and environmental. Gawdat Bahgat, "Conclusion," in *Energy Security: An Interdisciplinary Approach* (Chichester: Wiley and Sons, 2011), 213.

⁷ Laura El-Katiri, "The Energy Poverty Nexus in the Middle East and North Africa," *OPEC Energy Review* 38, no. 3 (September 2014): 296-322.

⁸ David Rothkopf, "[Is a Green World a Safe World?](#)," *Foreign Policy*, August 22, 2009.

⁹ Kirsten Westphal and Susanne Droege, "Global Energy Markets in Transition: Implications for Geopolitics, Economy and Environment" in *Global Trends 2015: Prospects for World Society*, eds. Michele Roth, Cornelia Ulbert, and Tobias Debiel (Bonn: Development and Peace Foundation, Institute for Development and Peace, Kate Hamburger Kolleg/Centre for Global Cooperation Research, 2015): 235-54; Kirsten Westphal, "Energy in an Era of Unprecedented Uncertainty: International Energy Governance in the Face of Macroeconomic, Geopolitical and Systemic Challenges" in *Transatlantic Energy Futures: Strategic Perspectives on Energy Security, Climate Change and New Technologies in Europe and the United States*, ed. David Koranyi (Washington, D.C.: Center for Transatlantic Relations, SAIS, 2012), 1-26.

balance of power.¹⁰ Interestingly, Stefano Casertano asserts that the transition to renewable energy will “democratize” the energy supply and create new network structures.¹¹ This case can also be read in terms of civil nuclear energy, where the transition in the Middle East will favor those states with access to all relevant resources, such as uranium deposits, expertise, or technology. At the moment, though, Mehran Kamrava highlights the role of nuclear exporting countries and the economics of proliferation.¹² Peter Stoett elaborates that often multinational corporations influence the exportation of civilian nuclear technology. For example, from 2009, France’s president, Nicolas Sarkozy, entered nuclear cooperation agreements with Saudi Arabia, Algeria, Jordan, Libya, Qatar, the UAE, and Vietnam.¹³ French companies such as Areva, Bouygues Construction, Electricité de France, and Eurodif are all involved in the civil nuclear industry.

In Saudi Arabia, according to Prince Turki al-Faisal, the shift into conservation, renewables, and nuclear energy are linked to growing energy demand.¹⁴ The current subsidies regime in Saudi Arabia exacerbates the situation, no matter how cheap production and distribution costs are. Rachel Bronson focuses on changing consumption patterns and developments in energy extraction impacting the international relations of the Gulf, arguing that U.S. interests in the Arabian Peninsula amount to more than oil.¹⁵ However, the Gulf Cooperation Council pivot to Asia was marked in the United States by President George W. Bush’s 2006 State of the Union address to replace over 75 percent of U.S. oil imports from the Middle East by 2025.¹⁶ Jim Krane, Amy Myers Jaffe, and Jareer Elass look at nuclear energy not only as a long-term project with high upfront costs, compared to gas turbines for example, but also projects that lead to enhanced security, technology transfer, and other strategic benefits.¹⁷ Giacomo Luciani states that for the hydrocarbon exporters of the Gulf region in particular, there is a cogent economic rationale of utilizing low-cost capital to meet long-term energy and diversification needs.¹⁸

¹⁰ Sergey Paltsev, “[The Complicated Geopolitics of Renewable Energy](#),” *Bulletin of Atomic Scientists* 72, no. 6 (November 1, 2016): 390-95.

¹¹ Stefano Casertano, “Risiken neuer Energie - Konflikte durch erneuerbare Energien und Klimaschutz” (Risks of New Energy - Risks Posed by Renewable Energy and Climate Protection), *Brandenburg Institute for Society and Security* no. 9 (May 2012): 6.

¹² Mehran Kamrava, ed., *The Nuclear Question in the Middle East* (New York: Columbia University Press, 2012).

¹³ Peter Stoett, “Toward Renewed Legitimacy: Nuclear Power, Global Warming, and Security,” *Global Environmental Politics* 3, no. 1 (February 2003): 114.

¹⁴ Dan Drollette Jr., “[View from the Inside: Prince Turki al-Faisal on Saudi Arabia, Nuclear Energy and Weapons, and Middle East Politics](#),” *Bulletin of the Atomic Scientists* 72, no. 1 (January 2, 2016): 19.

¹⁵ Rachel Bronson, “The United States in the Middle East: Bound by Growing Energy Demand,” *Middle East Policy* XXI, no. 2 (Summer 2014): 34-39.

¹⁶ Jan Kalicki, “Rx for ‘Oil Addiction’: The Middle East and Energy Security,” *Middle East Policy* XIV, no. 1 (Spring 2007): 78.

¹⁷ Jim Krane, Amy Myers Jaffe, and Jareer Elass, “Nuclear Energy in the Middle East: Chimera or Solution?,” *Bulletin of Atomic Scientists* 72, no. 1 (2016): 44-51.

¹⁸ Giacomo Luciani, “Nuclear Energy Developments in the Mediterranean and the Gulf,” *The International Spectator* 44, no. 1 (2009): 113-29.

Thus, there is a broad range of cross-cutting demands, motivations, and aspirations that account for nuclear energy assuming an important role in the energy mix of Middle Eastern states. On the economic side, the most important issues tend to be addressing rising domestic energy consumption and population growth (see Table 1 and Table 2) in addition to enhancing energy security and maximizing foreign earnings.

Table 1: Electric Power Consumption (kWh per capita)

	2008	2009	2010	2011	2012	2013	2014
Egypt	1,447	1,512	1,551	1,659	1,659	1,659	1,658
Saudi Arabia	7,189	7,468	7,974	8,024	8,523	8,816	9,444
UAE	11,614	10,966	10,968	10,612	10,698	10,953	11,264

Source: World Bank Group

Table 2: Population Projection (in millions)

	2015	2020	2025	2030	2035	2040	2045	2050
Egypt	93.78	102.94	111.47	119.75	128.26	137.07	145.58	153.43
Saudi Arabia	31.56	34.71	37.29	39.48	41.32	42.78	44.03	45.06
UAE	9.15	9.81	10.44	11.06	11.64	12.21	12.72	13.16

Source: Population Estimates and Projections, World Bank Group, updated December 18, 2017

Potential Links Between Civil Nuclear Energy and Weaponization

The literature on possible links between civil nuclear energy and a weaponized program is much more fragmented, with Bahgat concerned that the drivers for nuclear weapons are similar to those for other weapons of mass destruction and that all national security concerns should be addressed holistically.¹⁹ In fact, national security is interpreted somewhat differently by the UAE, Saudi Arabia, and Egypt. These states see political Islam, especially the proscribed Muslim Brotherhood, which enjoys support from Turkey and Qatar, as a dangerous affront to national unity (since the Muslim Brotherhood is a panregional organization). Even when interpreted in strictly national security terms, nuclear weapons would be useless at tackling a diffuse ideological threat. As Jacques Haymans notes, psychology also comes into play.²⁰ Even at the sharp end of sectarian conflict, Saudi Arabia and Iran confront each other through relatively low-cost activities, such as utilizing proxies in Syria, Iraq, Lebanon, and Yemen. Where power vacuums have afforded space to violent Islamist groups such as the Islamic State in Iraq and the Levant and al-Qaeda, nuclear-weapons use has never been contemplated by state

¹⁹ Gawdat Bahgat, *Proliferation of Nuclear Weapons in the Middle East* (Gainesville: University Press of Florida, 2007).

²⁰ Jacques E. C. Haymans, *The Psychology of Nuclear Proliferation: Identity, Emotions and Foreign Policy* (Cambridge: Cambridge University Press, 2006).

actors. Other weapons of mass destruction have also been available, such as sarin, chlorine,²¹ and phosphorus.²² For the UAE and Saudi Arabia, in particular, as well as many other Gulf Arab states, their security is to a great extent measured by a delicate balance of power with Iran in the Gulf region. For the time being, at least, this looks set to be assured by U.S. military deployments in the Gulf and by enhanced monitoring and controls provided by the Joint Comprehensive Plan of Action between the permanent four members of the U.N. Security Council (minus the United States), plus Germany and Iran. While that could change if Iran were deemed to have achieved breakout capacity or an actual nuclear warhead, it is likely that pre-emptive strikes by U.S. and Israeli forces would intervene.

Catherine Collins and Douglas Frantz suggest that terrorist networks, including those involved during the Abdul Qadeer Khan network's operation in an unregulated political and military environment from the mid-1970s, continue to seek to augment their capabilities by accessing nuclear materials and technology.²³ Of greater relevance to this paper are the origins

of Khan's nuclear expertise, gained during a period spent at a uranium enrichment plant for civil reactors in the Netherlands.²⁴ From there he copied designs for centrifuges and compiled a list of European companies that might provide Pakistan with the technology

Where power vacuums have afforded space to violent Islamist groups such as the Islamic State in Iraq and the Levant and al-Qaeda, nuclear-weapons use has never been contemplated by state actors.

necessary to produce highly enriched uranium for a nuclear weapon.²⁵ The foreign policy complexities associated with the administration of President Jimmy Carter cutting off military aid to Pakistan over its covert construction of a uranium enrichment facility became apparent in December 1979 when the Soviet Union invaded Afghanistan. Facing a new geostrategic reality, President Ronald Reagan offered a \$3.2 billion aid package to Pakistan and removed pressure that may have prevented Islamabad from attaining nuclear weapons technology.²⁶ Nicholas Miller asserts that nonproliferation regimes have improved since then and have managed to sever the links between nuclear energy and nuclear proliferation. He further highlights the importance of diplomacy and sanctions over unilaterally attempting to impose the "gold standard."²⁷ Mohamed Ibrahim Shaker concurs that nonproliferation regimes will be enhanced by the regionalization of nuclear energy in the Middle East, to the extent that a

²¹ Tim Lister, "[Analysis: Why Use Chlorine Bombs in Syria](#)," *CNN*, September 7, 2016; Thomas Gibbons-Neff, "[Syrian Forces Used Gas Attacks as Key Part of Campaign to Retake Aleppo, Human Rights Watch Says](#)," *The Washington Post*, February 13, 2017.

²² Thomas Gibbons-Neff, "[Saudi Arabia Appears to be Using U.S.-Supplied White Phosphorous in its War in Yemen](#)," *The Washington Post*, September 19, 2016.

²³ Catherine Collins and Douglas Frantz, "[How One Scientist Helped the World Go Nuclear](#)," *Foreign Affairs*, January 31, 2018.

²⁴ *Ibid.*

²⁵ *Ibid.*

²⁶ Bernard Gwertzman, "[Pakistan Agrees to a U.S. Aid Plan and F-16 Delivery](#)," *The New York Times*, September 16, 1981.

²⁷ Nicholas L. Miller, "Why Nuclear Energy Programs Rarely Lead to Proliferation," *International Security* 42, no. 2 (Fall 2017): 40-77.

roadmap can be drawn up and a weapons of mass destruction-free zone in the Middle East potentially implemented as a result.²⁸ The conference on a such a zone was supposed to take place in 2012 but was never convened due to the instabilities caused by the Arab uprisings.

Bahgat also states that nuclear weapons are the deadliest type of weapons of mass destruction as the detonations over Hiroshima and Nagasaki illustrate; they are also very expensive and difficult to manufacture (especially the enrichment process²⁹); and the international regulatory regime that governs nuclear weapons is more complicated than those for biological or chemical weapons, which are banned outright.³⁰ Intense nuclear diplomacy in the lead up to the JCPOA illustrates such complexities.³¹ Marzieh Kouhi Esfahani and Ariabarzan Mohammadi cover the Russian nuclear revival, the Non-Proliferation Treaty, and U.S. coercive diplomacy as well as background on Israeli, Pakistani, and Indian nuclear proliferation.³² Notwithstanding the JCPOA, they find that U.S.-Russian nuclear diplomacy has been moribund since 2010. Yet there are even more concerns since the release of the 2018 U.S. Nuclear Posture Review, which suggests China and Russia are trying to change the post-Cold War order through asymmetric means, such as modernization of nuclear systems and expanding capabilities.³³

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In February 2019, President Donald J. Trump announced the United States would be withdrawing from the Intermediate-Range Nuclear Forces Treaty with Russia, partly to tackle the imminent danger of North Korea but also in order to address these other challenges.³⁴

However, as Olli Heinonen notes, even in a period of instability and lack of diplomatic progress, technical preparatory work could be undertaken to support the process.³⁵ Saudi Prince Turki al-Faisal has pointed to a regional security architecture through which states can resolve their various differences beyond nuclear issues and provide civil nuclear power incentives to join and remain in the zone (in every possible way – economically, diplomatically, militarily) and sanction those outside of it (i.e. Israel).³⁶ He has also stated that a weapons of mass destruction-free zone should be enforceable by the U.N. Security Council.³⁷ Israel is unlikely to give up

²⁸ Mohamed Ibrahim Shaker, "Regionalizing Nuclear Energy in the Middle East: Making Progress on the Nuclear- and WMD-Free Zone," *Global Governance* 20, no. 4 (October 2014): 517-28.

²⁹ Three types of enrichment were used in the aforementioned bombs due to uncertainties about their effectiveness. "The Manhattan Project: An Interactive History," U.S. Department of Energy, accessed March 27, 2019.

³⁰ Gawdat Bahgat, *Proliferation of Nuclear Weapons in the Middle East* (Gainesville: University Press of Florida, 2007), 1.

³¹ See Trita Parsi, *Last Roll of the Dice: Obama's Diplomacy with Iran* (New Haven: Yale University Press, 2012).

³² Marzieh Kouhi Esfahani and Ariabarzan Mohammadi, eds., *Nuclear Politics in Asia* (Abingdon: Routledge, 2018).

³³ Oliver Thränert, "President Trump's Nuclear Posture Review," *CSS Analysis in Security Policy* no. 223 (March 2018): 2.

³⁴ Julian Borger, "Donald Trump Confirms US Withdrawal from INF Nuclear Treaty," *The Guardian*, February 1, 2019.

³⁵ Olli Heinonen, "The Middle Eastern Weapons of Mass Destruction Free Zone (WMDFFZ) – Nuclear Verification," *Belfer Center for Science and International Affairs*, July 16, 2012.

³⁶ Dan Drollette Jr, "View from the Inside: Prince Turki al-Faisal on Saudi Arabia Nuclear Energy and Weapons, and Middle East Politics," *Bulletin of the Atomic Scientists* 72, no. 1 (January 2, 2016): 18-21.

³⁷ Robert Mason, "Iranian Foreign Policy: The Politics of Civilisation, Security and Economy," in *Foreign Policy in Iran and Saudi Arabia: Economics and Diplomacy in the Middle East* (London: I.B. Tauris, 2015), 134.

its policy of nuclear ambiguity as its threat perception remains high and national security is of paramount concern (and unlikely to be subordinated to any United Nations-brokered deal or guarantees). Therefore, there remain significant impediments to advancing this framework. A regional security framework includes a huge range of issues that became apparent after Secretary of State Mike Pompeo's remarks about a new Iran treaty in May 2018 after the United States withdrew from the JCPOA. The British foreign secretary at the time, Boris Johnson, said that addressing the disparate and diverse issues of ballistic missiles, Iran's disruptive activity in the region (e.g. support for Hezbollah), and the nuclear question, would not be easy to achieve in a reasonable time frame.³⁸ The best option may therefore be in advancing more targeted bilateral agreements on enrichment and processing technology: the so-called 123 agreements.³⁹

Other literature looks at specific aspects of civil nuclear safety such as Eric Schlosser's volume about one-in-a-million or mundane accidents (e.g. caused by cleaning or repair staff) at nuclear power plants and military bases (such as at Damascus, Arkansas).⁴⁰ Another subset of volumes focus on uranium and the risks surrounding the mining and use of it in energy, military, or medical applications. For example, Anthony Burke explores the safety and security considerations of mining and transporting the "strategic substance," as well as the impact of lobbying groups on government decision making.⁴¹

Although there is scant evidence of civilian nuclear power facilitating weaponized programs, much depends on U.S. policy and nuclear agreements going forward, especially in the areas of uranium mining and spent fuel reprocessing (areas that currently form important aspects of the gold standard). Finally, there remains a staggering number and range of safety and security concerns that should be taken into consideration in curtailing the nuclearization of the Middle East, disasters, and the potential for a nuclear arms race.

The following sections discuss the adequacy of civil nuclear energy within a conceptual framework that addresses political motives, proliferation risks, and nuclear safety in the context of the UAE, Saudi Arabia, and Egypt.

United Arab Emirates

The UAE has worked closely with the International Atomic Energy Agency and joined all the relevant international conventions concerning civil nuclear power; the UAE ratified a safeguard agreement with the IAEA in 2003 and appointed an ambassador to the IAEA in 2008. In October 2009, the Federal Law Regarding the Peaceful Uses of Nuclear Energy was implemented. It provides for the licensing and control of nuclear material, prohibits uranium enrichment or spent fuel processing facilities in the UAE, and established the independent Federal Authority

³⁸ Tim Ross and Thomas Penny, "[U.K. Slams New U.S. Iran Plan Even Before Pompeo Presents It](#)," *Bloomberg*, May 21, 2018.

³⁹ Robert Mason, "[Abandon a Middle East Weapons of Mass Destruction Free Zone](#)," *Georgetown Journal of International Affairs*, October 30, 2012.

⁴⁰ Eric Schlosser, *Command and Control: Nuclear Weapons, the Damascus Accident and the Illusion of Safety* (New York: Penguin, 2014).

⁴¹ Anthony Burke, *Uranium* (Cambridge: Polity Press, 2017).

for Nuclear Regulation.⁴² In September 2015, the Federal Authority for Nuclear Regulation signed a five-year agreement with the U.S. Nuclear Regulatory Commission to exchange technical information, cooperate on nuclear safety research, and enable training programs.⁴³ The Emirates Nuclear Energy Corporation is the government vehicle for strategic investment in the industry and has an international advisory board, including leading experts such as Hans Blix.⁴⁴

In contrast, Iran has not joined many international conventions, such as the Convention on Nuclear Safety, and is the only country in the world with a major nuclear program that is not a member.⁴⁵ Iran persistently challenges the normative approach of the Non-Proliferation Treaty, which it perceives as a tool of Western domination, and hedges by exploiting loopholes, notably through achieving a near breakout capacity option of being able to enrich to 20 percent, allegedly within days.⁴⁶

The UAE also leveraged popular domestic support to be able to complete the Arab world's first commercial nuclear reactor at Barakah in March 2018. Public trust is a vitally important aspect of building a nuclear industry, since there will be a host of issues that require high degrees of confidence on the part of policymakers and regulators. For example, Finland is currently considering a radioactive waste disposal plan that involves a vast depository in granite rock but is not open to waste imports.⁴⁷ During such a turbulent period in Middle East politics, any regional arrangement is unlikely to present itself in the near future, but for states such as the UAE already implementing a nuclear power program, long-term waste disposal solutions will have to be found.

The UAE civil nuclear program has been built by Korea Electric Power Corporation and cost \$25 billion. The first UAE plant was ready to fuel in May 2018 but may not be operational until 2021.⁴⁸ In total, there are four plants (5.6 gigawatts when operational), which are expected to contribute 25 percent of the country's electricity. They will enable the UAE to export more of its hydrocarbons to maximize its foreign earnings. Although the UAE has the seventh largest natural gas reserves in the world, due to the rising demand created by rapid economic growth, it has become a net importer of natural gas, relying on states such as Qatar to supply most of the shortfall.⁴⁹ This would seem to be problematic given the intention of the countries boycotting Qatar (Saudi Arabia, the UAE, Bahrain, and Egypt) on isolating Doha. But with energy demand projected to continue to increase dramatically, the UAE needs Qatar and nuclear power to keep fuel prices manageable, and there is no sign yet that Qatar will cut gas exports to the UAE for retaliatory purposes. Natural gas could contribute half the amount

⁴² "[Nuclear Power in the United Arab Emirates](#)," World Nuclear Association, accessed May 2018.

⁴³ Ibid.

⁴⁴ Ibid.

⁴⁵ Martin B. Malin, "[Nuclear Energy in the Middle East? Regional Security Cooperation Needed](#)," *Afkar/Ideas*, (Spring 2017).

⁴⁶ Tehran Times, "[Iran Can Resume Nuclear Enrichment to 20% Purity in 2 Days](#)," March 5, 2018.

⁴⁷ Robert Matthews, "[The Question of Nuclear Waste in the UAE](#)," *The National*, July 18, 2015.

⁴⁸ Bruce Stanley and Heesu Lee, "[UAE Completes First of Four Korean-Built Nuclear Reactors](#)," *Bloomberg*, March 26, 2018.

⁴⁹ Charles Ebinger et al., "Civil Nuclear Power in the United Arab Emirates," in *Models for Aspirant Civil Nuclear Energy Nations in the Middle East*, *Brookings Policy Brief* 11 (September 2011): 3.

of energy required while renewables just 6 to 7 percent.⁵⁰ However, with heavy investment in solar power projects such as the 100-megawatt Shams (Sun) development and what is expected to be the world's largest project – Sweihan – when it comes online in April, the UAE is aiming to boost clean energy to 50 percent.⁵¹ Importing coal was dismissed as an option due to environmental and energy security concerns.⁵² The economic rationale for diversification into civil nuclear energy is therefore clear, but so too is the UAE's Executive Affairs Authority interest in diversifying supply to a range of sources of power to minimize risks associated with security of supply.⁵³

UAE transparency regarding its civil nuclear program stems from a 2008 white paper that evaluated the feasibility of civil nuclear power, identified the objectives to achieve it, and noted consultations with other nuclear powers, including those with civil nuclear technology. The UAE also coordinated with the IAEA. This all elicited a positive international response. The UAE preference has been for a third-generation light-water reactor technology based on a build, own, and operate model.⁵⁴ Contrary to the objectives of Iran and Saudi Arabia, for example, the UAE has renounced any intention to develop a domestic enrichment and reprocessing capability and has undertaken to source fuel from reliable foreign suppliers.⁵⁵ The “Roadmap for Success,” which followed the paper, outlines key goals such as: the highest standards of nonproliferation, the highest standards of safety and security, partnerships with governments

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and firms, and economical power generation.⁵⁶ The UAE recognizes that importance of human resource development strategies in building a civilian energy program, from working closely with its Korean nuclear supplier (there is a secondee from the Korean Institute for Nuclear Safety in Abu Dhabi) to developing a new cadre of senior reactor operators.⁵⁷ However, as a government program intent on Emiratization, an increasing nationalization of the workforce, there could be risks associated with displacing more qualified foreign workers, which could impact safety and security.⁵⁸ Generally speaking, though, the UAE effort looks set to be the benchmark for best practice or the “gold standard” on civil nuclear power in the Middle East.

By trailblazing civil nuclear power in the Middle East, the UAE will also encounter some issues that will affect other states set to adopt nuclear power as part of their energy mixes. Although unlikely events such as earthquakes and tsunamis can be guarded against through various

⁵⁰ “Nuclear Power in the United Arab Emirates,” World Nuclear Association, accessed March 2018.

⁵¹ Jeffrey Ball, “The New Age of Renewable Energy,” *Cairo Review of Global Affairs* (Winter 2018).

⁵² “Nuclear Power in the United Arab Emirates,” World Nuclear Association, accessed March 2018.

⁵³ Ibid.

⁵⁴ “Policy of the United Arab Emirates on the Evaluation and Potential Development of Peaceful Nuclear Energy,” *United Arab Emirates*, 7.

⁵⁵ Ibid, 9.

⁵⁶ Hamad Alkaabi, “UAE Nuclear Energy Program Overview,” *United Arab Emirates*, August 9, 2010.

⁵⁷ John Banks, Kevin Massy, and Charles Ebinger, eds., “Human Resource Development in New Nuclear Energy States: Case Studies from the Middle East,” *Brookings Energy Security Initiative Policy Brief* 12, no. 2 (November 2012): 10-12.

⁵⁸ Ibid, 14.

safety mechanisms, covert operations and targeted actions such as sabotage and terrorism, which the UAE will be particularly concerned about, will be more difficult to address. However, when it comes to public safety issues, the UAE has generally done well. Although there were 465 incidents of fire in 2017, including a major blaze at Dubai's 87-storey Torch Tower, one of the world's largest residential buildings, there were seven deaths and 68 injuries.⁵⁹ Emergency response time was 7.7 minutes.⁶⁰ In the case of the UAE, nuclear safety revolves less around safety and more around the broader issue of security, especially violent Islamist groups that may see UAE counterterrorism operations in Yemen as a good reason to target these kinds of installations or intercept enriched uranium fuel or waste transfers nationally or regionally, possibly in the Gulf region, in order to create a dirty bomb. Such blowback from military operations, and from foreign policy and politics more generally, will increasingly dovetail with nuclear safety considerations.

By trailblazing civil nuclear power in the Middle East, the UAE will also encounter some issues that will affect other states set to adopt nuclear power as part of their energy mixes.

Saudi Arabia

By 2032 Saudi Arabia is aiming to build at least two large nuclear reactors. This is scaled back from 16, which were estimated to cost more than \$80 billion.⁶¹ These reactors are expected to provide 17 gigawatts of electricity, about 15 percent of the kingdom's power, by 2040.⁶² The shift to clean and renewable energy forms part of Saudi Arabia's Vision 2030, which calls for diversification of the economy before its supply of oil and natural gas run out. The kingdom expects to get 40 gigawatts of electricity from solar capacity.⁶³ Saudi Arabia is already developing a massive solar installation at Sakaka in the north that is expected to produce electricity at some of the lowest prices in the world.⁶⁴ Although solar power is cheaper than nuclear power, it also lacks the prestige of a nuclear power program in terms of the scientific achievement required. If there is heavy investment in wind farms as well, Saudi Arabia should be a key player in these clean and renewable energies as oil and gas run out but only if energy subsidies and domestic consumption are reined in.

Saudi Arabia also has more modest goals and investments than those of the UAE, and there is uncertainty about implementation. The Saudi rationale for civil nuclear power is similar to that of the oil rich UAE: diversification of fuel sources for a population moving to modern cities in the desert where air conditioning and desalination are a priority and maximizing revenue from exporting oil rather than burning it for domestic energy needs. There are more specific

⁵⁹ Ali Al Shouk, "[Cigarette Butts Behind 14 Dubai Fires in 2017](#)," *Gulf News*, May 6, 2018.

⁶⁰ Ibid.

⁶¹ "[Nuclear Power in Saudi Arabia](#)," World Nuclear Association, accessed May 2018.

⁶² Ibid.

⁶³ Ibid.

⁶⁴ Jeffrey Ball, "[The New Age of Renewable Energy](#)," *Cairo Review of Global Affairs* (Winter 2018).

issues beyond the collapse of crude prices from 2014. Domestic food and oil subsidies are taking their toll, as is the Saudi intervention in Yemen. The Saudi budget fell from \$755 billion in 2015 to less than \$500 billion in 2018.⁶⁵

In 2008 Saudi Arabia signed a memorandum of understanding with the United States on civil nuclear energy cooperation, encompassing medical, industrial, and municipal power generation.⁶⁶ Saudi Arabia has also established the King Abdullah City for Atomic and Renewable Energy and has signed agreements with Argentina, China, France, and South Korea.⁶⁷ Much of this centers on a new strategy since March 2015 calling for smaller Self-Monitoring Analysis and Reporting Technology nuclear reactors for the purposes of electricity generation and water desalination. The Korea Atomic Energy Research Institute is assessing the feasibility for such reactors, as is a joint venture between Argentina (Investigación Aplicada) and Saudi technology innovation company Taqnia. Meanwhile, China Nuclear Engineering Corporation is conducting a feasibility study on using high temperature reactors for seawater desalination and possibly in the petrochemical industry.⁶⁸

The Saudi civil nuclear strategy is similar to that of the UAE in that it emphasizes the development of its human capital. For example, Areva Saudi Arabia and Electricité de France Saudi Arabia have both agreed to train workers. However, Saudi Arabia differs from the UAE because it is intent on developing an indigenous supply chain, building new industries but with the potential to compete with Iranian enrichment activities, should they resume. In March and August 2017, the Saudi Geological Survey and China National Nuclear Cooperation signed agreements to cooperate in the exploration for uranium deposits in the kingdom as part of Vision 2030.⁶⁹ Through the King Abdullah City for Atomic and Renewable Energy, Saudi Arabia looks set to develop nuclear cooperation with third parties such as Hungary and Kazakhstan focused on fuel supply. Jordan is also interested in smaller power plants.⁷⁰ That is because small modular reactors can desalinate water and generate electricity, addressing both needs simultaneously, require a lower capital commitment, and can serve both urban and remote areas.⁷¹

Saudi Arabia has had a safeguard agreement with the IAEA since 2009 but departs from the UAE's best practice by not having signed an Additional Protocol yet.⁷² Saudi Arabia's public statements concerning developing its own nuclear weapons if Iran does complicate assessments on Saudi Arabia's civil nuclear power.⁷³ So too does alleged Saudi financial support for, and options to procure, Pakistani nuclear warheads "off-the-shelf." Pakistan denies that

⁶⁵ Steven Mufson, "[Why Trump Might Bend Nuclear Security Rules to Help Saudi Arabia Build Reactors in the Desert](#)," *The Washington Post*, February 20, 2018.

⁶⁶ Wyn Bowen and Matthew Moran, "Living with Nuclear Hedging: The Implications of Iran's Nuclear Strategy," *International Affairs* 91, no. 4 (2015): 698.

⁶⁷ Ibid.

⁶⁸ "[Nuclear Power in Saudi Arabia](#)," World Nuclear Association, accessed May 2018.

⁶⁹ Ibid.

⁷⁰ Ibid.

⁷¹ Nabegh Al Sabbagh, "[The Case for Developing Nuclear Energy in the Middle East](#)," *Atlantic Council*, April 6, 2016.

⁷² Mark Hibbs, "[Safeguards for Saudi Arabia](#)," *Carnegie Endowment for International Peace*, November 27, 2018.

⁷³ "[Saudi Arabia Will Seek to Develop its Own Nuclear Weapons if Iran Does: Foreign Minister](#)," *The National*, May 9, 2018.

any such relationship exists.⁷⁴ Nevertheless, in 1999 Prince Sultan bin Abdelaziz al-Saud, then Saudi defense minister, visited a Pakistani enrichment center in Kahuta, outside Islamabad, prompting a formal U.S. diplomatic protest.⁷⁵ A nuclear weapons transfer could still be an option in grave circumstances (e.g. a direct confrontation between Saudi Arabia and Iran) or as a second strike guarantee. Saudi Arabia and Pakistan have close military-to-military contact (including training programs), as well as aid and diplomatic relations. Saudi Arabia also has Chinese nuclear-capable but conventionally armed missiles capable of reaching Tehran.⁷⁶ Considering the lack of traction for a weapons of mass destruction-free zone conference, a more assertive leadership in Riyadh, and the escalation of tensions with Iran, the Saudi nuclear power strategy becomes more concerning. Furthermore, for a state that frames its civil nuclear program largely in economic terms, it is cheaper to buy uranium from international markets than enrich it domestically.⁷⁷ The crossover between nuclear and foreign policy is already evident in the Saudi proposal to set up a military base, build a canal, and dump nuclear waste in a burial site on Salwa island, effectively turning Qatar into an island as part of the Saudi boycott against the government in Doha.⁷⁸

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The United States remains the lynchpin for further nuclear development in the kingdom and, should Saudi Arabia proceed without a 123 agreement with the United States, the fallout could be severe for Crown Prince Mohammed bin Salman's attempts to modernize the kingdom.⁷⁹ The situation is already fraught with various political risks, including bilateral tensions over the murder of Saudi journalist Jamal Khashoggi in the Saudi Consulate in Istanbul.⁸⁰ Saudi Arabia may look to how the UAE managed to move past a similar incident that threatened to derail its bilateral nuclear energy deal with the United States in 2010.⁸¹ Trump's decision to withdraw from the JCPOA and enact further sanctions against Iran may provide a useful context in which to get Saudi Arabia to commit to a nuclear negotiation that addresses proliferation concerns, such as foregoing uranium enrichment and spent fuel processing.⁸² Much depends on fresh U.S. attempts to constrain Iranian enrichment outside of the JCPOA and the Iranian responses in turn, including any escalation of tensions with Israel or Saudi Arabia.

⁷⁴ "Pakistan Denies Saudi Nuclear Sale," *AFP*, June 5, 2015.

⁷⁵ Simon Henderson, "Saudi Nuclear Power Plants and the Danger of Proliferation," *The Washington Institute for Near East Policy*, February 28, 2018.

⁷⁶ Simon Henderson, "Saudi Nuclear Power Plants and the Danger of Proliferation," *The Washington Institute for Near East Policy*, February 28, 2018.

⁷⁷ Joe Cirincione, "Selling Saudis the Nuclear Rope to Hang US," *Loblog*, March 2, 2018.

⁷⁸ Jane Dalton, "Saudi Arabia Mulls Plans to Turn Qatar into Island by Building Canal Along Border and Dumping Nuclear Waste There," *Independent*, April 10, 2018.

⁷⁹ Thomas Lippman, "Saudi Arabia's Nuclear Future" in *The Nuclear Question in the Middle East*, ed. Mehran Kamrava (New York: Columbia University Press, 2012), 105-25; Thomas Lippman, "Saudi Arabia and the Nuclear Temptation," *Loblog*, April 13, 2018.

⁸⁰ Katrina Manson, "US Congress Sours on Alliance with Saudis After Khashoggi Killing," *Financial Times*, October 24, 2018.

⁸¹ Paul Harris, "Outrage at Acquittal of Abu Dhabi Sheikh in 'Torture' Tape," *The Observer*, January 17, 2010.

⁸² Chen Kane and Ramya Ramjee, "Washington's Plan for a Nuclear Agreement with Saudi Arabia May Be in Jeopardy," *The National Interest*, May 9, 2018.

The disparate nature of international nuclear relationships, the nuclear risk dynamic, and the fragile nature of some Middle Eastern governments make U.S. attempts to manage civil nuclear power agreements and the nonproliferation regime difficult. Indeed, with growing competition from Russia and China (which demand less stringent nonproliferation, nuclear security, and nuclear safety conditions than the United States) the Trump administration is under pressure to relax rules on enrichment to ensure U.S. commercial engagement.⁸³ If successful in negotiating a 123 agreement, it may enable the United States to monitor or influence the Saudi nuclear situation from the inside. This was a point highlighted by Khalid al-Falih, the Saudi minister of energy, industry, and mineral resources in March 2018.⁸⁴ However, a 123 agreement without the gold standard, but rather separately negotiated, stringent mechanisms in a limited time agreement, such as that offered to Morocco (expires 2022), Turkey (expires 2023), and Egypt (expires 2021), would simply delay the safeguards that the gold standard offers.

The insecurity that this delay can cause was evident in the stalled negotiations with Iran, enabling it to accumulate 20,000 centrifuges before the JCPOA took effect. It led the United States and Israel to undertake cyber and covert operations against Iran in 2012.⁸⁵ A relaxed U.S. approach would open the doors for other newcomers to demand the same treatment and water down existing agreements when they come up for renewal. While these are binding agreements, they are also susceptible to work arounds. For example, Iran, while respecting the terms of the JCPOA, has hinted at launching seaborne reactors apparently in responses to comments made by Trump before he withdrew the United States from the JCPOA.⁸⁶

The hardest part of any potential weaponized nuclear program is not in creating the delivery mechanism, it is enriching uranium to a high level. It requires a vast industrial effort. For example, the bomb dropped on Hiroshima used three different types of highly enriched uranium.⁸⁷ Therefore, preventing enrichment should certainly focus on the most stringent controls, as afforded by the gold standard. The chances of Saudi Arabia getting a good deal, for example, being allowed to enrich under a cooperative agreement with the United States, are high as Trump appeared to have accepted Saudi Arabia getting a nuclear deterrent

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⁸³ Michael Flynn, who was briefly Trump's national security advisor before he was forced to resign over making false statements about his communications with Russians, attempted to get the ball rolling with his Marshall Plan for the Middle East through nuclear cooperation with Russia in 2015.

⁸⁴ Timothy Gardner, "[Saudi Arabia Has Options if U.S. Walks from Nuclear Power Deal: Minister](#)," *Reuters*, March 23, 2018.

⁸⁵ David E. Sanger, "[Obama Order Sped Up Wave of Cyberattacks Against Iran](#)," *The New York Times*, June 1, 2012.

⁸⁶ Francois Murphy, "[Iran Hints at Seaborne Reactors While Respecting Nuclear Deal](#)," *Reuters*, February 22, 2018.

⁸⁷ William J. Broad, "[The Thin Line Between Civilian and Military Nuclear Programs](#)," *The New York Times*, December 5, 2007.

during the 2016 presidential election campaign.⁸⁸ The State Department is still short on a full contingent and there is little expertise in the White House on nonproliferation issues. The role of Congress in this negotiation will therefore be paramount.

There are also a host of other concerns about the Saudi nuclear program. Similar but perhaps more concerning than the terrorism threat to the UAE are the various security threats to the kingdom. Saudi Arabia already experienced an insurgency by al-Qaeda in the early 2000s, and now both al-Qaeda and ISIL have a presence in Yemen, which could serve as a base for future attacks. The Houthis have launched multiple missile attacks against Saudi Arabia,

targeting the airport and the royal palace in Riyadh.⁸⁹ They have also used missiles to attack a Saudi Aramco facility in the south.⁹⁰ If Saudi Arabia is in a position to support the rollout of small modular reactors across the kingdom, especially

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close to its borders with Iraq or Yemen, and in other countries, it would bring with it the potential for greater risk. The risks of such a geographically broad network were underscored by the temporary loss of radioactive material from Iraq in 2016.⁹¹ However, there are also some advantages of small modular reactors, such as less enriched fuel required, a longer fuel cycle that gives reduced access to fissile material, as well as a higher burn up rate, which reduces the amount of available spent fuel.

Egypt

Egypt has a longer history with nuclear energy than both the UAE and Saudi Arabia. Equally important, Cairo has been a leading player in the regional and global efforts to establish a Middle East nuclear weapons-free zone. In the spirit of President Dwight D. Eisenhower's Atoms for Peace Initiative, Egypt started its own nuclear program in the mid-1950s, when President Gamal Abdel Nasser created the Egyptian Atomic Energy Authority, as the leading institution in promoting the peaceful application of nuclear science and technology. Since then, the Egyptian Atomic Energy Authority has established three scientific centers: Nuclear Research Center, National Center for Radiation Research and Technology, and Hot Laboratories and Waste Management Center.⁹²

Another step was the inauguration of a 2-megawatt reactor in Inshas in the Nile Delta in 1961. The Soviet Union supplied the reactor and controlled the disposal of spent fuel, which "was not capable of producing a significant amount of weapons-grade material."⁹³ In the early 1980s

⁸⁸ Chris Cillizza, "[Donald Trump Did a CNN Townhall Last Night. And It was a Classic](#)," *The Washington Post*, March 30, 2016.

⁸⁹ Patrick Wintour and Saeed Kamali Dehghan, "[Saudi Arabia Shoots Down Houthi Missile Aimed at Riyadh Palace](#)," *The Guardian*, December 19, 2017.

⁹⁰ "[Saudis Say Shoot Down Yemeni Missile Aimed at Oil Installations](#)," *Reuters*, December 22, 2015.

⁹¹ Nabegh Al Sabbagh, "[The Case for Developing Nuclear Energy in the Middle East](#)," *Atlantic Council*, April 6, 2016.

⁹² "[About Us](#)," Egyptian Atomic Energy Authority, accessed March 28, 2019.

⁹³ Shai Feldman, "Middle East Nuclear Stability: The State of the Region and the State of the Debate," *Journal of International Affairs* 49, no.1 (Summer 1995): 205-30.

the IAEA provided Egypt with technical assistance and equipment to update the reactor and improve its safety procedures. The reactor has been shut down for a number of years due to lack of funding and technical difficulties.

Egypt's second nuclear reactor was built by INVAP S.E. (an Argentine state-owned applied research company), also located in Inshas. It is a 22-megawatt, multipurpose reactor used for radioisotope production and research on neutron physics materials science, nuclear fuel, and boron neutron capture therapy.⁹⁴ It went critical in 1997 and was officially inaugurated in February 1998 by President Hosni Mubarak and his Argentine counterpart, President Carlos Menem. The two reactors have been used for scientific research and peaceful purposes and have been subject to IAEA safeguards. In addition to these two reactors, over the last few decades Egypt has sought, unsuccessfully, to buy a number of reactors from other countries (e.g. France, Germany, Austria, China, and the United States).

Finally, after years of hesitation and negotiation, in April 2013 Egypt approached Russia to renew its nuclear cooperation agreement, focused on construction of a nuclear power plant in El Dabaa and joint development of uranium deposits.⁹⁵ In late 2015 Egypt signed an intergovernmental agreement with the Russian state-owned Rosatom to build a \$30 billion nuclear power plant in El Dabaa. Russia is expected to provide a \$25 billion loan. Rosatom plans to commission the first unit in 2026 and will supply nuclear fuel to each of the four 1,200 megawatt reactors throughout the plant's entire operational lifetime.⁹⁶ In December 2017 Russian President Vladimir Putin visited Cairo and signed a final agreement with Egypt's president, Abdel Fattah al-Sisi.

Egypt's decadeslong history of interest in nuclear power has been driven mainly by three interrelated forces: regional security, national pride, and energy needs. The combination of these forces has shaped the country's nuclear program since its inception in the mid-1950s and is likely to continue driving nuclear developments in the foreseeable future. In the late 1950s and early 1960s Egypt was involved in a nuclear race with Israel, which at the time Egypt considered an enemy. The two countries sought to acquire nuclear material and technology that could eventually give them the means to build a nuclear bomb. There is no way to determine with certainty whether Egypt under Nasser initiated the nuclear infrastructure in the mid-1950s to serve military or exclusively peaceful purposes. However, in the first part of the 1960s Cairo embarked on its most active period of nuclear program expansion. This could have been in response to Israeli Prime Minister David Ben-Gurion's acknowledgement of his country's nuclear reactor in Dimona.⁹⁷

The 1967 war with Israel dealt a heavy blow to Egypt's nuclear program. By losing oil fields in Sinai and Suez Canal remittances the government did not have the necessary financial resources to fund the nuclear program. Within this context, there are no credible indications that Cairo has actively pursued a nuclear-weapons program since 1967. Indeed, rhetoric aside,

⁹⁴ "ETRR-2 Reactor (Egypt)," INVAP, accessed March 28, 2019.

⁹⁵ "Nuclear Power in Egypt," World Nuclear Association, accessed March 28, 2019.

⁹⁶ "Egyptian Project on Schedule," Egyptian Nuclear Power Plants Authority, October 11, 2018.

⁹⁷ Avner Cohen and William Burr, "How the Israelis Hoodwinked JFK on Going Nuclear," *Foreign Policy*, April 26, 2016.

the Egyptian leadership has never made the strong commitment necessary to carry out such a huge undertaking. Human and financial resources have never been adequately mobilized to achieve this goal.

Instead of ambiguous efforts to acquire nuclear weapons, Egypt has focused on exerting pressure on Israel to give up its nuclear option and join the Non-Proliferation Treaty. In July 1968 Egypt signed the treaty, hoping to put pressure on Israel to follow suit. Cairo, however, delayed ratifying it as leverage in arms reduction negotiations. After making peace with Israel and adopting a pro-Western foreign policy, the Egyptian leadership ratified the Non-Proliferation Treaty in February 1981. This step was also taken to enhance the country's chances of receiving foreign technology needed to expand its civilian nuclear program.

To sum up, there are some indications that Egypt might have thought to build a nuclear program for military purposes in the late 1950s and early 1960s. If this was the case, these efforts have been fundamentally shelved since the 1967 war. Instead, Cairo has sought to achieve military parity with Israel by advocating for a Middle East nuclear weapons-free zone, which, since 1974, Egypt has been calling for, along with Iran.⁹⁸ This ambitious adventure is not likely to materialize any time soon. There are no indications that

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Israel is willing to give up its unacknowledged nuclear option. Furthermore, given the close and growing Egyptian-Israeli cooperation, the Israeli nuclear option may not pose a national security threat to Egypt. Rather, the interest in nuclear power is, in part, a matter of national pride.

Given Egypt's history, military power, cultural dominance, and political weight, Egyptian leaders have always claimed a leadership status in the Arab world. Despite declining economic power and political instability, Cairo still enjoys tremendous soft and hard power and is widely seen as a key player in the Middle East and beyond. Against this background, the Egyptian opposition to the Iranian nuclear program is understandable. As a strong advocate for a Middle East nuclear weapons-free zone, Cairo has been against the proliferation of nuclear weapons. Still, Egyptian diplomats have supported Tehran's right to acquire peaceful civilian nuclear power as a member of the Non-Proliferation Treaty. Unlike their Israeli and Saudi counterparts, Egyptian leaders have been more accommodating of Iran's nuclear program and more supportive of negotiations with Tehran.

Iran's nuclear program does not pose a national security threat to Egypt. The two regional powers have not had "warm" relations since the 1979 Islamic Revolution. For many years, Egypt has been a key ally to Saudi Arabia and the UAE – Iran's main regional rivals. Egyptian leaders have repeatedly argued that the security of these Arab countries is an indispensable component of Egypt's own security. On the other hand, Cairo has been hesitant to play an active role in regional conflicts like Yemen or Syria. This suggests that rhetoric aside, a military confrontation between Cairo and Tehran by traditional or nontraditional means is not likely.

⁹⁸ Patricia M. Lewis, "A Middle East Free of Nuclear Weapons: Possible, Probable or Pipe-Dream?," *International Affairs* 89, no. 2 (March 2013): 433-50.

In Egyptian eyes, the Iranian nuclear program presents a challenge to its own national pride and prestige. Seeing itself as the Middle East's leading power, the Egyptians have a hard time accepting another regional power, Iran, making such a claim, which is clearly linked to technological advancement and scientific progress. Therefore, acquiring civilian nuclear power and developing indigenous human resources are likely to go a long way in satisfying Egyptian national pride and in sustaining its claim of regional leadership.

A close examination of Egypt's energy outlook suggests that the country's growing demand and declining production are the main economic-related drivers for diversifying the energy mix and acquiring nuclear power. The country's share of the world's proven oil reserves is only 0.2 percent and natural gas is 0.9 percent.⁹⁹ Despite these limited reserves, Egypt is the largest oil producer in Africa outside of OPEC members and the third-largest natural gas producer on the continent following Algeria and Nigeria. On the other hand, Egypt is the largest oil and natural gas consumer in Africa, accounting for about 22 percent of petroleum and other liquids consumption and 37 percent of natural gas consumption in Africa in 2016.¹⁰⁰

Instead of ambiguous efforts to acquire nuclear weapons, Egypt has focused on exerting pressure on Israel to give up its nuclear option and join the Non-Proliferation Treaty.

These soaring consumption levels are largely due to decadeslong generous energy subsidies. Working with the International Monetary Fund, the Egyptian government has taken significant steps to cut these subsidies since 2016. Another key reason for the high consumption level is sustained population growth. The Egyptian population is approximately 100 million people. In addition to public subsidies and population explosion, economic growth, particularly in energy-intensive industries like petrochemicals, is another major driver of high energy consumption. From 2007 to 2017 average gross domestic production growth was 4.3 percent due mainly to economic reforms attracting foreign direct investment and a diversified economy, including tourism, manufacturing, and construction industries.¹⁰¹

On the production side, the energy sector, like the rest of the economy, has been traditionally dominated by state-owned corporations and has offered limited opportunities for foreign investment. Again, supported by the IMF, World Bank, and African Bank of Development, the Egyptian government has introduced new policies to promote economic reform. For example, in 2013-14, the government started implementing a more favorable upstream development policy to reverse the country's declining gas supply profile. New policy measures helped bring about the discovery of the Zohr field in 2015 and its fast-track development. Other gas discoveries (West Nile Delta, Greater Nooros, and Atoll) were made in recent years.¹⁰² In December 2017, Italy's ENI delivered the first gas from Zohr field and BP delivered the first gas from Atoll.¹⁰³

⁹⁹ "BP Statistical Review of World Energy," British Petroleum, June 2018.

¹⁰⁰ "Egypt," Energy Information Administration, accessed March 28, 2019.

¹⁰¹ International Monetary Fund Middle East and Central Asia Dept., *Arab Republic of Egypt: Selected Issues* (Washington, DC: International Monetary Fund, December 11, 2017), 9.

¹⁰² Mostefa Ouki, "Egypt - A Return to a Balanced Gas Market?," *The Oxford Institute for Energy Studies*, June 2018.

¹⁰³ Patrick Werr, "With New Gas Deals, Egypt Closes in on Energy Hub Goal," *Reuters*, December 28, 2017.

Despite these positive developments, currently oil and gas consumption outpaces production and the country is a net importer of both. In February 2018 Israel announced a \$15 billion contract to export natural gas to Egypt over 10 years.¹⁰⁴ Addressing production and consumption challenges and liberalizing the energy sector and the economy will take a long time. Sensitive social, economic, and political issues need to be dealt with in a gradual manner. This means that the need for nuclear power is genuine and growing.

Conclusion

While there is a common political elite interest in establishing a civil nuclear energy infrastructure to address a socioeconomic need, there is diversity in the political and security experiences of Abu Dhabi, Riyadh, and Cairo that informs their threat perceptions and interest in deterrence. The driving economic factor for pursuing civil nuclear power – diversifying the energy mix and freeing up more hydrocarbons to export – appears to be relevant in other countries. For instance, according to the World Nuclear Association, there were 153 nuclear reactors under construction around the world as of June 2018.¹⁰⁵ This interest in generating nuclear power, however, still faces significant hurdles. Unlike Saudi Arabia and the UAE, Egypt is likely to face tremendous financial challenges during the implementation phase. In 1992 Mubarak estimated that the construction of three or four nuclear plants would cost \$18-20 billion. He concluded, “Frankly, I would be leaving a debt for the citizens, a burden on the people. I cannot do this. I do not want to add more burdens than the people can endure.”¹⁰⁶ Today, the cost is much higher. This means that Russian financing will continue to feature in Cairo’s economic and political calculations. Civil nuclear power and the financing of similarly large-scale and long-term infrastructure projects requires further exploration as they remain important in the contemporary study of developing states.

The cases shed light on potential concerns about the nature of nuclear proliferation risks associated with individual civil nuclear programs as well as safety concerns. The academic literature on the connection between civilian nuclear power and proliferation of nuclear weapons and the historical experiences do not suggest a clear pathway. Neither is there clarity on the nexus of motivation for civil nuclear programs, risks to nonproliferation norms, and nuclear safety. However, the national interest in nuclear power in these three countries seems primarily driven by economic considerations, not military power considerations, for at least three reasons.

First, much of the primary focus regarding national security is on nonstate actors, such as the Muslim Brotherhood, and states that support political Islam, such as Qatar, Turkey, and Iran. Saudi Arabia has traditionally benefitted from U.S. protection under its security umbrella. Even if this logic were to be questioned, Saudi Arabia benefits from additional security relations with nuclear-armed states such as Pakistan. Since the Israeli threat perception is closely aligned to Saudi Arabia’s concerning Iran, this would amount to another layer of protection. The general

¹⁰⁴ Heba Saleh, Mehul Srivastava, and Andrew Ward, “[Israel Bolsters Egypt Ties with \\$15bn Gas Deal](#),” *Financial Times*, February 19, 2018.

¹⁰⁵ “[World Nuclear Power Reactors & Uranium Requirements](#),” World Nuclear Association, accessed March 28, 2019.

¹⁰⁶ Barbara Gregory, “Egypt’s Nuclear Program: Assessing Supplier-Based and Other Developmental Constraints,” *Nonproliferation Review* 3, no.1 (Fall 1995): 20-27.

threat perception across the region supports the rationale behind building up conventional forces and arms imports, developing broad counterterrorism alliances, and maintaining a high level of control domestically.

Second, despite the so-called “shale gas revolution” and the significant improvement in the U.S. oil and gas outlook, the notion of “oil for security” in the Middle East is not dead. As the largest economy in the world, the United States has economic and strategic interests in maintaining an uninterrupted supply of oil from the Gulf region at reasonable prices, especially during a period when Trump is ratcheting up sanctions against Iran. Any attempts at covert enrichment would undermine regional security in the same way that undeclared Iranian uranium enrichment did; this would be counterproductive to the national security calculations of states that rely on close cooperation with the United States. The presence of international political controversies, domestic considerations such as economic development and diversification goals, and the presence of third parties such as the United States and European Union in the region, continues to affect decision making and cost-benefit analysis. However, states such as Russia and China, which are more willing to challenge U.S. policy in the Middle East and U.S. nuclear power more broadly, are an important countercurrent to consider when assessing this issue.

Third, Israel has had peaceful relations with Egypt since the two countries signed a peace treaty in 1979 and in recent years they have been working together to fight jihadists in Sinai. Similarly, in the last few years relations between Israel and both Saudi Arabia and the UAE have significantly improved mainly because they see Iran as their common enemy. Despite warm relations between Israel and some Arab countries, Israel still adheres to the “Begin Doctrine,” named after Israeli Prime Minister Menachem Begin, which is a clear and strict policy to prevent its neighbors from acquiring or developing weapons of mass destruction. Based on this policy, Israel destroyed nuclear weapons facilities in Iraq in 1981 and Syria in 2007.

From a safety and security perspective, there are a range of factors that should be considered in regard to civil nuclear energy: from tighter regulation of nuclear states that export nuclear power-related goods and services to geological factors and susceptibility to insecurity, attack, or sabotage. The Fukushima incident and other accidents such as Chernobyl illustrate how unforeseen events can impact local, national, and regional environments. This paper has raised further questions about the rollout of nuclear installations, particularly small modular reactors, which could be more susceptible to conflict spillover, insurgency, or terrorism than other types of installations. All three countries lack adequate human resources and need to educate and train more engineers and other workers to operate their nuclear facilities. They also need to develop a culture of nuclear safety, institutions, and proper regulations, rules, and laws. In short, the need for nuclear power is there, but so are significant challenges, each of which will have to be overcome if these Arab countries are to build and operate nuclear reactors.

