

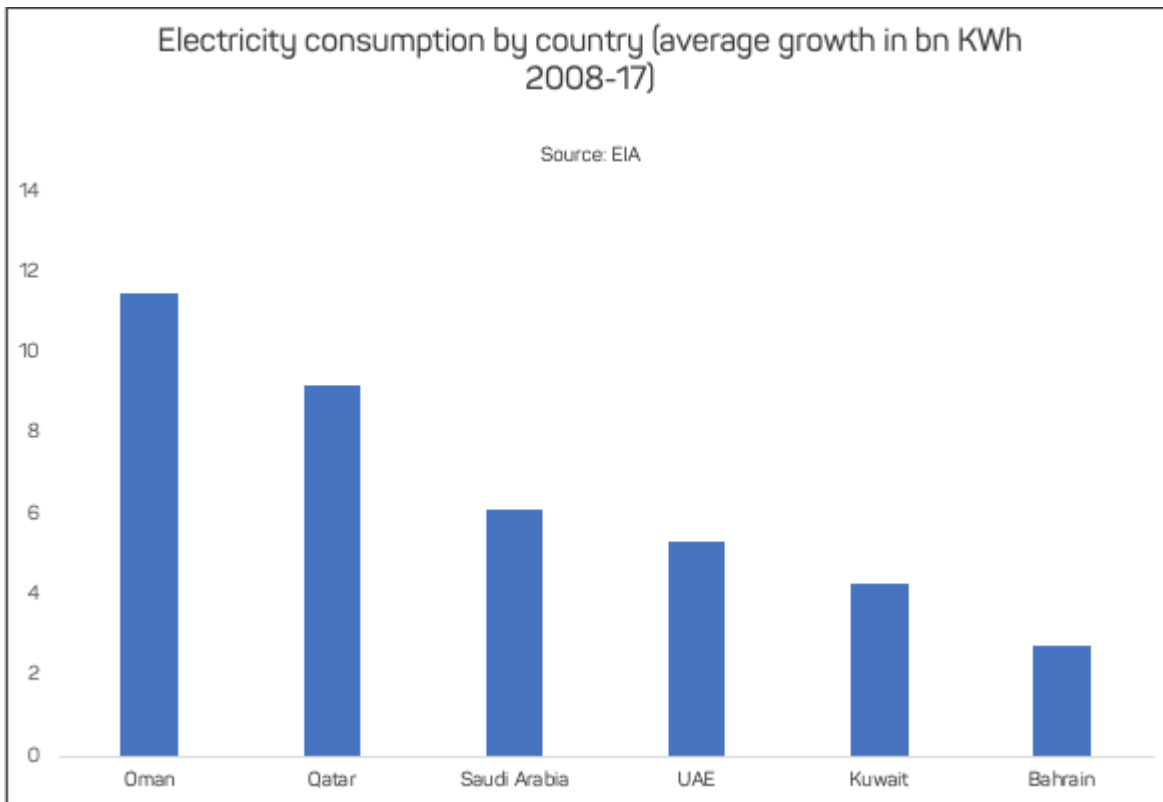
Rising electricity demand and an over-reliance on hydrocarbons for power generation are encouraging Saudi Arabia and the UAE to progress with nuclear development programmes. But the prohibitive costs of nuclear, coupled with water security issues and regional instability, are likely to stall progress of nuclear programmes in both countries, and deter other GCC nations from adopting nuclear agendas over the coming years.

Gulf Monitor | Georgina Hayden | Nuclear power

The development of civilian nuclear power has taken a more prominent place on the GCC's political agenda over the past decade. The development of domestic nuclear sectors presents an increasingly attractive large-scale, low-carbon power supply option as it allows countries in the region to meet rapidly rising electricity demand while also diversifying their energy mixes.

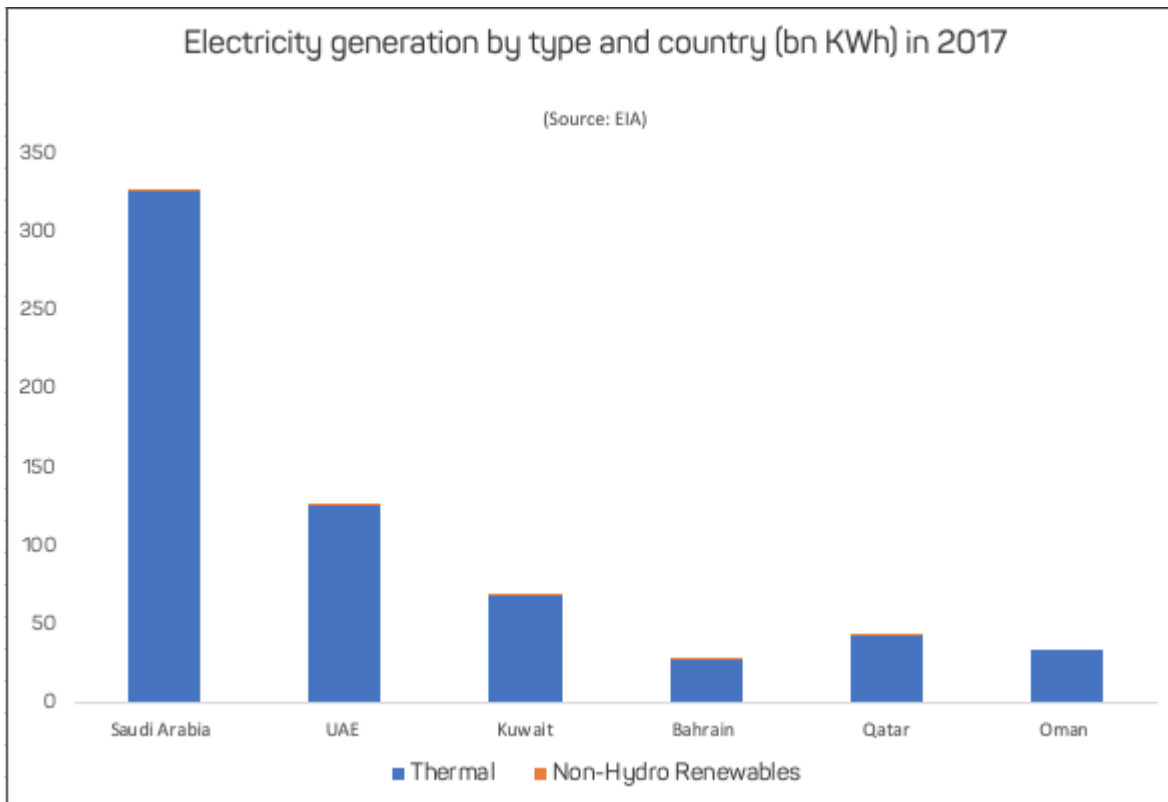
Diversification benefits

[Electricity demand in the GCC](#) region continues to rise rapidly, underpinned by population growth, the expansion of cities, high demand for energy-intensive desalinated water production and generally low levels of energy efficiency. The latter point is in part due to electricity subsidies, which undermine the incentive for consumers to conserve electricity. According to the US Energy Information Administration (EIA), electricity consumption in the GCC has increased by an annual average of 6.5% over the last decade.



High demand for electricity is coupled with the region's heavy reliance on hydrocarbons – particularly gas and oil – for power generation. Thermal electricity sources accounted for 99.5% of all electricity generation across the GCC in 2017, except in the UAE where renewable energy made up just 1% of the total power mix, with the remaining coming from thermal sources (predominantly gas).

Introducing alternative electricity sources into the domestic power mix would enable governments to conserve hydrocarbons for export and safeguard future revenues. This is especially important in a time of relatively low hydrocarbons prices and widespread fiscal constraints.



Nuclear programmes on the table for Saudi & UAE

In the latter half of the 2000s, momentum gathered behind developing nuclear power in the region. The GCC countries, alongside the International Atomic Energy Agency and led by Saudi Arabia, cooperated on a feasibility study for a regional nuclear power programme. Since then, two nuclear development schemes have been adopted, by the UAE and Saudi Arabia. While the other four countries do not have firm nuclear development plans, they potentially stand to benefit from both Saudi Arabia's and the UAE's nuclear ambitions over the longer term. With these two countries leading the way, plans to establish a GCC power grid – and the prospect of regional electricity trading – could come closer to being realised.

The UAE is progressing with plans to build four 1,400-MW nuclear units at Barakah in Abu Dhabi. Construction of Unit 1 is now complete and it is expected to come on-line this year, with the other three reactors currently under construction. The project, developed by a South Korean consortium, has already been delayed, but all units are set to be commissioned by 2023. The wider goal is to

increase the share of clean energy in the country's electricity capacity mix to 50% by 2050, with 44% from renewable energy and 6% from nuclear.

UAE nuclear power reactors under construction and planned (Source: World Nuclear Association)				
UAE Nuclear Projects	Reactor Type	MW	Construction start	Expected Commissioning
Barakah 1	APR1400	1400	Jul-12	2020
Barakah 2	APR1400	1400	May-13	2021
Barakah 3	APR1400	1400	Sep-14	2022
Barakah 4	APR1400	1400	Sep-15	2023
Total (4)	5600 MW			

Saudi Arabia has progressed less well with its highly ambitious nuclear programme. The kingdom originally set a target to develop nearly 18 GW of nuclear capacity by 2032; however, the target year has since been pushed back to 2040. That said, it still represents one of the largest nuclear programmes globally.

But despite the strong government support for the sector and limited public opposition to nuclear power in the UAE and Saudi Arabia, there are still numerous challenges facing project realisation. These are likely to stall progress of both countries' nuclear programmes and deter other countries in the region from adopting nuclear agendas over the coming years.

Capital constraints

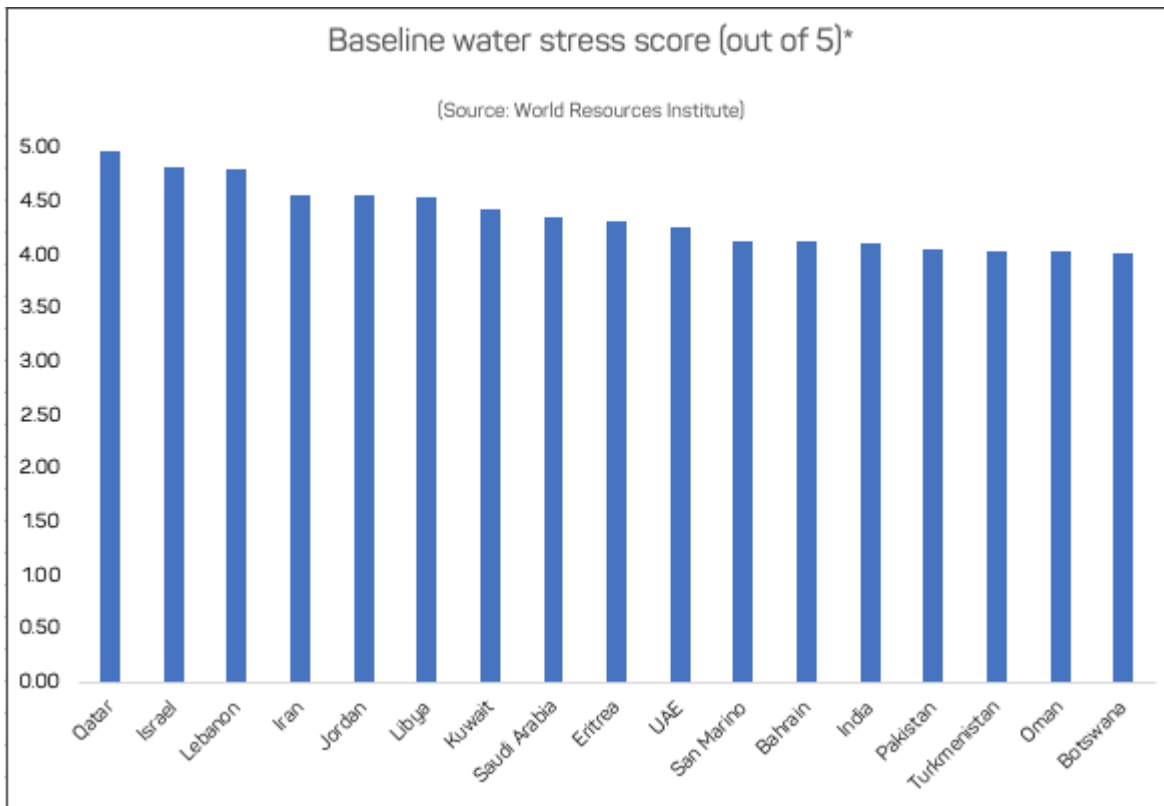
The cost of developing nuclear power projects is often prohibitive. Projects are extremely capital-intensive to build, while the cost of fuel, waste disposal and decommissioning means there are high long-run variable costs associated with nuclear generation. In contrast, solar photovoltaic systems are emerging as the cheapest source of electricity generation for new electricity generation projects in

the GCC, according to the International Renewable Energy Agency.[1] For example, the MBRAMSP IVb solar project in Dubai will sell electricity for \$0.02.4 cents per KWh. The lowest base case price of utility-scale electricity generation from nuclear in the GCC is higher than all other technologies, at around \$0.10 per KWh, above liquefied natural gas, oil, coal and significantly higher than gas (around \$0.03.5 per KWh).

These cost issues are particularly pertinent for the region given the general lack of cost-reflective power tariffs in the GCC. Electricity subsidies are deep-rooted and while policymakers have proposed reforming tariffs, resistance remains high. This implies that governments will have to bear significant costs in the form of nuclear power subsidies for projects to be commissioned. Amid a backdrop of persistently low oil prices and reduced oil production, the financial viability of the UAE and Saudi governments to fund their domestic nuclear programmes is questionable.

Water security

[Water scarcity is a well-documented problem](#): all six GCC countries are listed in the top 17 most water-stressed countries in the world (Saudi Arabia and the UAE are ranked 8th and 10th, respectively).[2] However, water demand from nuclear power generation is notably high: a study undertaken in 2012 concluded that the highest water withdrawal values in electricity generating technologies result from nuclear technologies.[3] As such, adopting nuclear power into the energy mix could have an adverse impact on water security in the region, while a lack of water supply could hinder generation at newly constructed nuclear projects.



**all countries categorised as having "extremely high baseline water stress"*

Regional instability

Developing a domestic nuclear sector brings with it wider political and security considerations. Issues surrounding nuclear safety, waste disposal, and the potential establishment a nuclear weapons programme have all served to derail nuclear programmes around the world.

These issues are exacerbated in the GCC and the wider Middle East given the general lack of internal [political stability](#) of the region. This association with long-term instability may result in major international powers putting diplomatic pressure on the GCC governments to cease nuclear development programmes.

Georgina Hayden is an energy consultant and co-founder of research and analysis firm, North Shore Analysis. She has a special interest in the low-carbon economy, and the challenges and opportunities facing stakeholders operating in an increasingly digitalised, decarbonised and decentralised energy system. Before that, she was Head of Power & Renewables Research at Fitch Solutions. She holds a

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Sources:

[1] 'Renewable Energy Market Analysis: GCC 2019', IRENA

-<https://www.irena.org/publications/2019/Jan/Renewable-Energy-Market-Analysis-GCC-2019>

[2] 'Water stress by country', World Resources Institute -

<https://www.wri.org/resources/charts-graphs/water-stress-country>

[3] 'Operational water consumption and withdrawal factors for electricity generating technologies: a review of existing literature', Environmental Research Letters -

<https://iopscience.iop.org/article/10.1088/1748-9326/7/4/045802/meta>