

A Fine Balance: The Geopolitics of the Global Energy Transition in MENA



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1 Introduction

The Middle East and North Africa (MENA) region¹ presents a curious challenge for the global energy transition. It remains the global centre of oil exports and is also a very important gas-exporting zone. Fast-growing populations, energy-intensive industrialisation, a series of oil-led booms, and provision of subsidised fuels, have led it to be amongst the highest energy-consuming regions in the world, whether per capita or per unit of GDP. Its infrastructure, economies, political systems and international relations have been profoundly shaped by hydrocarbon wealth, even in those regional countries with a smaller or no hydrocarbon endowment.

At the same time, MENA, with hot and mostly semi-arid or arid climates, and large concentrations of coastal urban development, is particularly vulnerable to climate change. Weak and/or repressive states are experiencing continuing political upheaval and conflict. Although climate change has not yet been a key driver or shaper of these conflicts, it could become an increasing future stressor, particularly in combination with economic decline driven by a loss of hydrocarbon rents. MENA, though, has excellent potential for low-carbon energy through renewables (mostly solar), and through a geological and industrial endowment suited for carbon capture, storage and use (CCUS).

¹Definitions vary; here the Middle East includes the six Gulf Cooperation Council (GCC) countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates), Yemen, Iran, Iraq, Syria, Lebanon, Jordan and Israel/Palestinian Territories, while North Africa includes Egypt, Libya, Tunisia, Algeria and Morocco with Western Sahara.

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The MENA countries are bound together by shared languages, religions and history. Yet, there are also profound differences between them, including their immediate neighbourhood, geography, colonial legacy, hydrocarbon endowment, non-hydrocarbon resources, level of economic development, size of sovereign wealth holdings, ethno-sectarian make-up, political system, ideology, international alliances and others. These idiosyncratic factors, as well as different choices and personalities in their political and business leadership, have shaped so far significantly different approaches to the global energy transition.

The current ‘energy transition’ globally can broadly be understood as a response to the imperative of climate change. Previous transitions, as from wood to coal, and from coal to oil and gas, have been driven by the availability, lower cost and improved convenience and utility of the new energy source. The current transition includes the attempt to promote low- or non-carbon energies (renewables, including solar, wind, biomass, hydropower, geothermal and others; nuclear; carbon capture and storage); non-carbon energy carriers (mostly electricity, but also hydrogen), for transport (electric vehicles), energy storage (batteries, thermal storage), industry and other uses; and improved energy efficiency and productivity (Bazilian and Howells 2019). The attempt to move away from fossil fuels has also been driven by local environmental and social impacts, by moves by consuming countries to increase energy security and reduce dependence on possibly unfriendly or unstable hydrocarbon exporters, as well as by (largely unfounded) concerns about resource scarcity. The energy transition also includes the quest for universal access to modern energy. It is not simply the introduction of new technologies, but also involves the changes in markets, institutions and regulations that allow or are induced by technological changes.

The energy transition brings with it shifts in corporate and national power. The geopolitics of the transition have begun to be considered, for instance, by the International Renewable Energy Agency (IRENA) (IRENA 2019), and other scholars.² In general, this work so far sees a strongly negative impact of the transition on current major fossil fuel exporters, including many MENA states as well as countries such as Russia, Venezuela and Nigeria.

In MENA, this transition is also bound up with a geoeconomic transition, which centres on the shift of oil and gas markets away from traditional customers in North America, Europe and developed Asia, and towards developing Asian countries, notably China and India. This is accompanied by trends in political power, notably the possible diminution of the US role in the region (particularly in the Persian/Arabian Gulf), the greater self-assertiveness of regional powers including Saudi Arabia, the UAE, Turkey and Iran, and the rising involvement of Russia and in future likely China and India. The MENA region faces these developments against the backdrop of global trends, such as a turn against free trade, the rise of populist economic and social policies, and a fracturing into geopolitical blocs, all further complicating the transition (Bazilian et al. 2019).

²For example, <https://www.belfercenter.org/publication/geopolitics-renewable-energy>, <http://www.dieterhelm.co.uk/energy/energy/burn-out-the-endgame-for-fossil-fuels-2/>.

MENA countries' responses to the energy transition revolve around four axes. The first is the restructuring of their economies to cope with lower prices for now, and permanently reduced hydrocarbon rents in the long term. The second is the attempt to safeguard the future of their hydrocarbon industries. The third is a gradual but accelerating move to retool their domestic energy systems for a lower carbon future. And the fourth is to deal with the geoeconomic transition.

2 The Nature of the Regional Energy Economy

The MENA region contains the majority of the world's oil reserves: 48.3% of world oil reserves in the Middle East, with a further 3.7% in North Africa (BP 2019). Its position in gas is less dominant but still very important, with 38.4% of world gas reserves in the Middle East and 4% in North Africa. More significantly, its resources are predominantly in large, conventional high-quality reservoirs with well-developed infrastructure and close to export routes, resulting in much lower production costs than the big but costly resources of US shale/tight hydrocarbons, Canadian oil sands and Venezuelan extra-heavy oil.

As a result, MENA provided 38% of gross world oil exports in 2018, much larger than any other region (Russia, with 12.8%, was next). It supplied 32.8% of world LNG exports (from a total 431 billion cubic metres (BCM), but a smaller share of gas exports by pipeline (4% from the Middle East, mostly within the region, and 5.4% from North Africa, mostly to Europe, from global international pipeline trade of 805.4 BCM). Even though North Africa's share of world exports is relatively small, it is important in the European market by supplying 13% of the continent's natural gas consumption and 10% of its oil.

The region has also become a much more significant consuming centre in its own right. It accounts for 17.3% of world gas consumption, 10.9% of oil consumption, 7.7% of carbon dioxide emissions from fuel combustion and 6.1% of electricity generation (BP 2019), although comprising only 5.7% of world population³ and 3.8% of GDP.⁴ This has been driven by a number of factors: the paucity of other traditional energy sources (hydropower and coal); the hot, arid climate with a high requirement for air-conditioning and desalination; the oil-driven economic boom of 2003–14; policies of energy-intensive industrialisation (oil refining, petrochemicals, aluminium, steel, cement, ceramics); and low, subsidised prices for energy which have encouraged inefficiency and waste.

The region remains almost entirely dependent on hydrocarbons for electricity (Fig. 1). However, this is likely to change substantially in the coming decades, as discussed in Sect. 6. The limited use of hydroelectricity today is virtually all in Iran, Iraq, Egypt and Morocco; that of nuclear in Iran; and coal in Israel and Morocco.

This hydrocarbon bounty is distributed unevenly across the region (Fig. 2). Some states (mostly the GCC and Libya) have small populations and large resources;

³World Bank, 2018 or closest available year.

⁴Nominal, 2018 or closest available year.

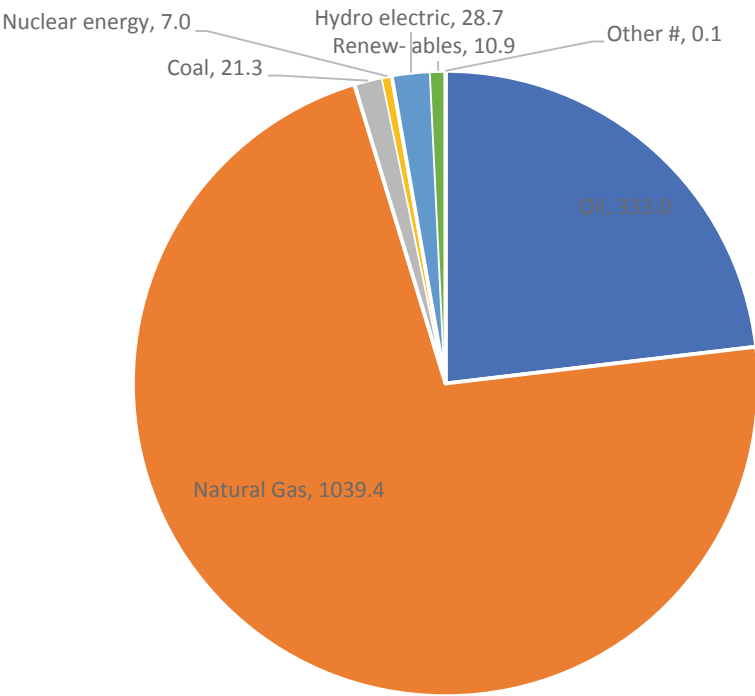


Fig. 1 Power generation by source, Middle East + Egypt (TWh/year 2018). *Source* BP Statistical Review of World Energy 2019

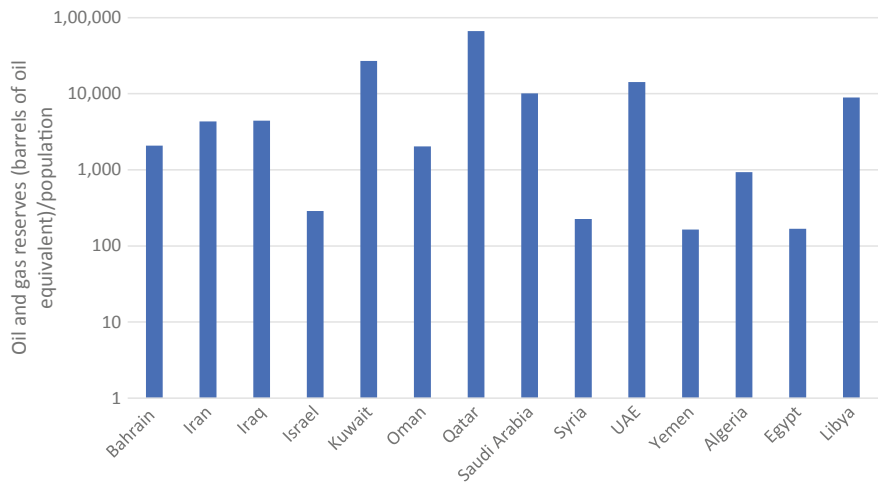


Fig. 2 Hydrocarbon endowment per capita (log scale). *Source* BP Statistical Review of World Energy 2019; Wood Mackenzie. Includes only total proved reserves of oil and gas; oil reserves include gas condensate and natural gas liquids (NGLs) as well as crude oil; Other countries not included due to negligible proved reserves

this is even more so when considering only the citizen populations, given shares of expatriates around 90% in Qatar (Snoj 2019) and the UAE (CIA 2019). Some, such as Iraq, Iran, Algeria, Yemen, Syria and Egypt, have significant resources but also relatively large populations. And others, notably Lebanon, Jordan, Morocco and Tunisia, have very little or no hydrocarbon production. Israel is in an anomalous position by virtue of its recent discovery of major gas fields, and its relative political and economic isolation from its neighbours. Yet even the oil and gas importers of the region are linked to their hydrocarbon-exporting neighbours by flows of labour, remittances and investment (Mohaddes and Raissi 2019).

The region is not highly integrated in trade or energy terms. This is due to the rather similar nature of exports and comparative advantage between most of the region states; political and security barriers; and a significant degree of protectionism.

Despite long negotiations, particularly with the UAE and Oman, Iran has not been able to start gas exports to its Gulf neighbours, due to unrealistic commercial expectations, political disputes, sanctions and high domestic use. The Arab Gas Pipeline (AGP) from Egypt to Jordan, Syria and Lebanon, and a related pipeline to Israel, the Arish–Ashkelon pipeline,⁵ functioned from 2008 to 2012 but were disrupted by sabotage in Sinai following the 2011 Egyptian Revolution, and gas shortages within Egypt itself. The most successful regional pipeline, Dolphin, runs from Qatar to the UAE and Oman, and started deliveries in 2007 to Oman and 2008 to the UAE (EIA 2011). Its operations have not been interrupted by the boycott of Qatar imposed by the UAE, Saudi Arabia and Bahrain in June 2017, but it has not been expanded either. The GCC Interconnection Authority, for electricity, has also continued to function, but it trades electricity only on an emergency or quantity basis, not on market terms, and utilisation has only been around 5–6% of capacity (KAPSARC 2018).

In the absence of reliable access to pipeline gas despite the proximity of huge resources, Kuwait (2009), Dubai in the UAE (2010), Abu Dhabi in the UAE (2016), Egypt (2015) (TAQA Arabia 2019), Jordan (2015) (The Jordan Times 2016), Israel (2013) (MEES 2013), Bahrain (2019) and possibly in future Sharjah in the UAE (2020), Lebanon (2021), Saudi Arabia (no firm date), Morocco (perhaps as late as 2028) (African Energy 2019) and possibly Tunisia (Songhurst 2019), have turned to LNG imports. Although far from economically optimal, this has reflected a pragmatic approach.

Yet, more recently, there have been some more welcoming suggestions for energy cooperation, with contracts on gas exports between Israel, Egypt and Jordan; agreements on electricity interconnections of Iraq with Jordan and the GCC; and discussions of cross-border gas and carbon dioxide pipelines between Saudi Arabia, Bahrain, the UAE and Oman.

⁵https://www.sourcewatch.org/index.php/Arish%E2%80%93Ashkelon_Pipeline.

3 Regional Conflict and Weak States

MENA has been a region of particular geopolitical volatility and contestation since the Second, perhaps even the First World War. Scholars continue to dispute the causes, but MENA has seen an unusually high number of inter-state and, more recently, intra-state conflicts, while other areas that were troubled in the 1960s and 1970s, such as Latin America and south-east Asia, are now relatively stable and peaceful.

Outright MENA wars include the various Arab–Israeli wars; the Lebanese civil war (1975–1990); the Iran–Iraq war (1980–88); Saddam Hussein’s invasion of Kuwait and US-led expulsion (1990–91); the Algerian civil war (1991–2002); civil war in Syria (2011–present) with various foreign interventions; the Libyan revolution and subsequent civil war (2011–present); civil war and regional intervention in Yemen (2015–present); and the US invasion of Iraq, subsequent civil war and conflict with the ‘Islamic State’ (2003–present). Accompanying these has been a level of insurgencies, territorial disputes, revolutions and coups (notably in 2011’s ‘Arab Spring’), severe international sanctions (at various times, on Iran, Iraq and Libya) and state repression. Major protests, sometimes to the stage of enforced changes of leadership, recurred in 2019 in Algeria, Sudan, Lebanon and Iraq.

Oil and gas resources have been the direct target of some of these conflicts, most clearly with the invasion of Kuwait. Oil rents have helped underpin well-armed autocratic governments with a tendency towards military approaches to disputes. The importance of the region for the global economy, and the prevalence of small, wealthy states who have relied on external patrons for security, has led to repeated intervention by the US, Russia and European countries. Intra-state ‘resource regionalism’ (Mills and Alhashemi 2018) has encouraged conflicts and separatism over resource-rich areas, such as the Kurdistan region of Iraq. Regional states have also developed ‘proxies’ and non-state allies in their weaker neighbours. Most notably Iran has patronised Hezbollah in Lebanon and the Houthi movement in Yemen, but Saudi Arabia, the UAE, Qatar and Turkey have played varying roles in these countries as well as in Libya, Egypt, Syria and Iraq.

Resource wealth has in many cases underpinned the development of modern states. It has also tended to entrench the power of authoritarian elites, whether republican, military or monarchical. Under internal stress, these states have proved to be brittle, with state failure particularly extreme in Yemen, Libya, Syria and Iraq.

The theory of the rentier state was developed by the Iranian economist Hussein Mahdavy (Mahdavy 1970), the Egyptian economist and former prime minister Hazem Beblawi, and the Italian economist Giacomo Luciani (Beblawi and Luciani 1987). They argued that states with large natural resource endowments or other ‘unearned’ income (such as foreign aid) were not reliant on taxing their people, but instead served to allocate or distribute the revenues, and that this would create a large unnecessary bureaucracy while reducing the incentives for hard work and government accountability.

Rentierism may be one part of the wider phenomenon of the ‘resource curse’,⁶ which has been used to describe the various negative effects of a heavy dependence on natural resource revenues: a lack of competitiveness in the non-resource economy and in manufacturing exports; slower overall GDP growth rates; an overvalued exchange rate; high macroeconomic volatility; weak and corrupt institutions; a tendency to authoritarianism and foreign and civil–military conflict, and a deficit in democracy, human rights and gender equality.

Some work (Brunnschweiler and Bulte 2006) has challenged the very existence of the resource curse; dismissed it as confusing the direction of causality (poorer countries have a higher share of natural resources in GDP, not vice versa); argued that it applies mostly to oil (not gas, minerals or agricultural resources); suggested that it applies mostly to the post-1973 period of elevated oil prices (Ross and Andersen 2012)⁷; or argued that it affects states with poor-quality initial institutions, and that better institutions bring a ‘resource blessing’. MENA countries also have a complex political and institutional history,⁸ including the legacy of Ottoman and Western imperialism. Nevertheless, many of the posited negative effects of rentierism and the resource curse, along with some of the benefits, are highly visible in the region.

MENA conflict has repeatedly threatened world oil and gas supplies, going back to the 1951–1953 nationalisation of Iranian oil and the subsequent US/British-backed coup; the 1956 Suez crisis; 1973–1974 oil embargo; and the 1979 Iranian Revolution. More recently, the Libyan Revolution and the sanctions placed on Iran by the Obama administration pushed oil prices to a range of \$100–110 per barrel. There have been repeated concerns over oil transit through the Strait of Hormuz in particular, and also through the northern and southern passages of the Red Sea, the Suez Canal and the Bab El Mandeb.

In contrast, tensions in the Gulf during 2018–2019 were severe, triggered by the Trump administration’s decision to abandon the Joint Comprehensive Plan of Action (JCPOA) nuclear deal with Iran, followed by sanctions intended to cut off its oil exports entirely. Yet, the September 2019 missile and drone attack on Saudi Arabia’s Abqaiq oil processing plant, and other strikes blamed on Iran or its allies, as well as attacks on Iran’s own shipping, had by October 2019 had virtually no lasting impact on oil prices, despite briefly taking out half Saudi production capacity.

This more relaxed attitude by markets can be explained by a negative outlook on the world economy and hence oil demand; by the availability of oil in strategic storage; by the confidence in US shale producers to ramp up production quickly in the event of a price spike; and, perhaps, to a sense that oil is losing its geopolitical importance in the longer term, as non-oil alternatives enter the mainstream.

Historically, and even up to 2008, OPEC cartel power, oil supply disruptions and fears of ‘peak oil supply’ were a strong justification for countermeasures by the developed countries: the International Energy Agency, founded in 1974 (IEA

⁶Reviewed in https://www.jstor.org/stable/25054077?seq=1#page_scan_tab_contents.

⁷With regards to transitions to democracy, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2104708.

⁸See, for instance, Lapidus (2018), *A History of Islamic Societies*, Cambridge University Press.

2019), and its coordination of strategic stocks; programmes of alternative energy (nuclear, coal, biofuels and the beginnings of modern wind and solar); high fuel taxes; efficiency standards and conservation; and incentives for new oil development (Alaska and the North Sea in the 1970s and 1980s) and unconventional fossil fuels. With lower world oil prices post-2014, and a much more relaxed attitude to future supply, environmental drivers have supplanted security concerns as the main impetus for support for electric vehicles and other non-oil technologies.

4 Economic Restructuring and Resilience

For all the talk of renewables in the energy transition, the most intense effect on MENA oil and gas has so far come from competition from another hydrocarbon producer—the US. The rise of shale and tight oil and gas output has led the US from being the world's biggest oil importer as recently as 2013, to being the world's largest producer, ahead of Saudi Arabia and Russia, and at times a net oil exporter during 2019. Simultaneously, in seeking to export its surplus of cheap gas, the US also challenges Qatar and Australia as the largest LNG exporter over the next few years, with Russia coming up in fourth place. Finally, abundant low-cost feedstock has also caused a renaissance in US petrochemical production, a further challenge to Gulf industry.

In late 2014, oil prices fell from \$100 per barrel to as low as \$26 in January 2016, and have only partially recovered since to around \$60 per barrel as of October 2019, despite the virtual elimination of Iranian and Venezuelan exports. After a surge in LNG prices in 2018 (Singapore LNG Index reached \$11.66 per million British thermal units (MMBtu) in August 2018⁹), primarily due to China's coal-to-gas switching, spot prices fell back in mid-2019 to around \$4 per MMBtu, though long-term contract prices remained higher.

This has put profound pressure on fiscal and current account balances for the MENA hydrocarbon exporters (Fig. 3). Investment budgets and subsidies have been cut, while non-oil revenues have been raised by introducing various fees and taxes, such as value-added tax (VAT) in some of the GCC countries. Budget gaps have been plugged by debt issuance, both at the sovereign level and by state firms, often the national oil company, with Saudi Aramco, Abu Dhabi National Oil Company (ADNOC) and Petroleum Development Oman (PDO) all floating sizeable bonds.

However, there has been relatively little progress in reducing the large public-sector wage bill, or on privatisation. Indeed, protests in countries such as Oman in the wake of the Arab revolutions in 2011, and in Iraq in 2019, have been met with promises of even more fiscally unsustainable state handouts. The much-heralded proposed initial public offering (IPO) of Saudi Aramco might realised \$29.4 billion for a 1.7% stake, and the sale of 10% of ADNOC Distribution (the company's fuel retail arm) on the local market raised \$851 million in 2017 (Gulf Business 2017),

⁹Energy Market Company Pte Ltd (EMCSG).

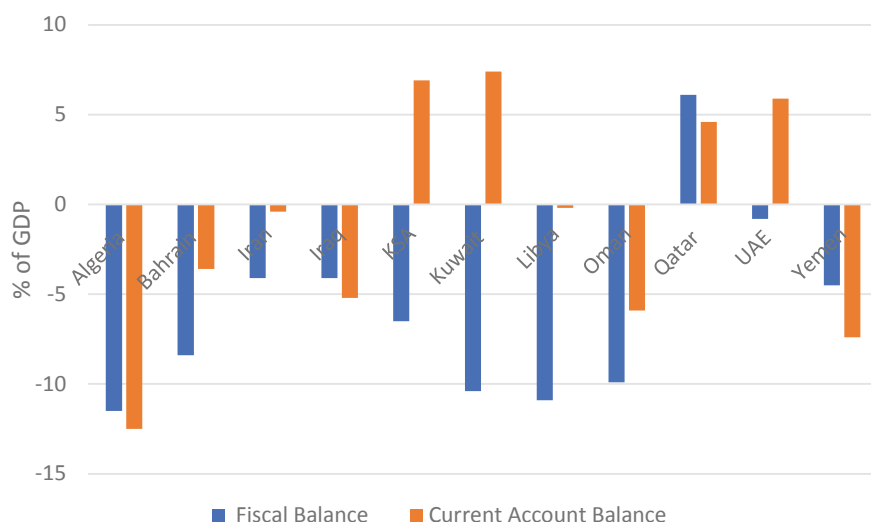


Fig. 3 Budgetary and current account balances, MENA oil exporters, 2019 estimate. *Source* Arabia Monitor; IMF

but these amounts are not particularly material in the big picture, and the companies involved are already well-run. Their importance is more for injecting a commercial mindset and stimulating progress in privatising other less effective entities.

Attempts at diversification from oil date back to the 1970s; in the case of Iran, to the 1960s. Diversification has passed through a number of eras (Hvidt 2013). In the 1970s, the fear was that resources would deplete in the relatively near future. The high oil prices of the time gave an abundant source of funds for investing in new industries, which of course were also tempting to bureaucrats and rent-seeking businesspeople. In the 1980s and 1990s, low oil prices created awareness of the need to find other sources of income.

In the 2000s, a renewed influx of petroleum revenues allowed investment in infrastructure, real estate and energy-intensive industries such as aluminium, steel, cement and petrochemicals, usually supported by cheap, subsidised energy. Saudi Arabia, in particular, developed more advanced petrochemical activities via firms such as Saudi Arabia Basic Industries Corporation (SABIC). Iran, under the pressure of sanctions, also built up industry to serve domestic needs and create export products that were less vulnerable than crude oil to interruption. Although not exactly a diversification away from energy, these industries do offer more technological sophistication and a reduced correlation with world oil prices.

Surplus revenues were used to build up large sovereign wealth funds, particularly in the UAE, Kuwait and Qatar. These have a mix of objectives: avoiding upwards pressure on the pegged currencies; saving to reduce macroeconomic and budget volatility driven by oil price changes; saving for a future of diminished oil revenues; and investing strategically in the domestic and international economy. At the same

time, some states, notably the UAE, Oman and Bahrain, diversified into tourism, aviation, logistics, financial services and other non-oil activities, even if these did not contribute much to budgetary revenues¹⁰ and remained largely dependent on the wider regional economy.

In the latest era of diversification, widespread regional political unrest (since 2011) and lower oil prices (since 2014) have again concentrated attention on the development of the non-oil economy. Another imperative has been added: the prospect of peak oil demand. Although most Gulf policymakers still do not expect this to be soon, a slowing of demand and falling prices within the next 20 years or so still represents an enormous challenge. In 2015, Abu Dhabi's crown prince Mohammed bin Zayed stated in a speech that, "In 50 years, when we might have the last barrel of oil, the question is: when it is shipped abroad, will we be sad? If we are investing today in the right sectors, I can tell you we will celebrate at that moment" (TheNational.ae 2015). In April 2016, Saudi Crown Prince Mohammed bin Salman (MBS) reflected on a much shorter timeline: "I think by 2020, if oil stops we can survive. We need it, we need it, but I think in 2020 we can live without oil" (QUARTZ 2016).

Most of the MENA countries have an 'economic vision' for some future date, 2030 or another. Saudi Arabia's 'Vision 2030',¹¹ launched under MBS, is one of the most recent and influential. Yet its attention to the energy sector is surprisingly limited, with more focus on technology, tourism and social transformation. The major energy goals outlined in the Vision 2030 are to maintain oil production capacity at 12.5 million bbl/day by 2020, increase raw gas production capacity from 12 billion cubic feet per day (Bcf/d) to 17.8 Bcf/d in 2020 (with a further target of 23 Bcf/d by 2027), increase domestic refining capacity from 2.9 million bbl/day to 3.3 million bbl/day by 2020, and phase out energy subsidies by 2025 (were previously planned to be phased out by 2020). This reflects a tension between the oil and non-oil sectors. Should hydrocarbon rents simply be a cash cow, funding investment into diversification? Or should the existing strengths of the oil sector be the foundation for a more value-added and environmentally sustainable energy industry, at home and abroad? In September 2019, this question seemed to be answered, at least for now, when experienced technocrat Khalid Al Falih was replaced as energy minister by MBS's half-brother, Prince Abdelaziz bin Salman, and as Aramco chairman by Yasir Al Rumayyan, MBS confidant and head of the key Public Investment Fund (PIF), with holdings in Tesla, Uber and other future-oriented companies.

The challenges of rapidly retooling entire economies remain enormous. In a recent paper, Steffen Hertog concludes that, "Even under ideal conditions, it will be impossible to become 'post-rentier' by 2030 and hard to imagine even by 2050. The maths are quite similar for other high-rent countries, including those of the GCC" (POMEPS 2019). While the Gulf countries have at least articulated a vision of diversification and taken some significant steps towards it, other MENA hydrocarbon-exporting

¹⁰Dubai being an exception.

¹¹<https://vision2030.gov.sa/en>.

countries have struggled. Iran has already a fairly diversified economy, with sanctions pushing it towards further self-sufficiency and lower dependence on oil revenues, but at the cost of a severe recession. Iraq's cumbersome bureaucratic and sectarian system is straining to deliver results in the oil, gas and electricity sectors, but progress beyond these is very limited. The constant state of crisis management militates against longer term planning, despite the schemes laid out in studies by the World Bank (World Bank 2012) and International Energy Agency (IEA 2012). Algeria too struggles to sustain its petroleum exports, let alone diversify, with an excessively bureaucratic system and hostility to foreign investment. And the internationalised civil wars in Syria, Libya and Yemen of course make long-term economic progress impossible.

A further question is whether the expected fall in hydrocarbon revenues, at least relative to the rest of the economy, will reverse the 'resource curse' and rentierism described above.¹² More likely, this will not be automatic, and true diversification will rest on building up strong and capable institutions. Ultimately, less dependence on resource rents may diminish military competition and within-state conflict. But in the medium term, economic stress and a struggle over the remaining rents may lead to more violent confrontations, as with Saddam Hussein's decision in 1990 to invade Kuwait to try to solve his regime's financial problems (Karsh and Rautsi 2008).

5 Future-Proofing the Hydrocarbon Industry

5.1 *Current and Future Challenges*

The future of the MENA hydrocarbon industry reflects a delicate balance between meeting current challenges and ensuring its future resilience. The nature of this task, and the methods used, vary according to the exigency of each country's situation.

5.1.1 Climate

The primary challenge of the large GCC oil producers—Saudi Arabia, the UAE and Kuwait—is how to maximise the value of their resources in a climate-constrained world, where they face significant non-OPEC competition. The other big oil resource holders—Iraq, Iran and Libya—ought to be thinking similarly, but are battling political and security problems that prevent their planning effectively for the long term, as are Syria and Yemen. The lesser producers, such as Algeria, Egypt, Oman, Bahrain

¹² Addressed in, for instance, <https://bruegel.org/2017/08/towards-eu-mena-shared-prosperity/>.

Yet, as noted below, Saudi Aramco has implemented a number of policies to reduce its emissions and prove its business against climate policies.

Every MENA country except Libya and Yemen (for understandable reasons), Iraq and Iran has submitted a document on Nationally Determined Contributions (NDCs) towards meeting its Paris goals (Yemen, Iran and Iraq have submitted Intended NDCs). These generally include improvements in energy efficiency both in generation and use; gains in renewable and sometimes nuclear energy; fuel substitution; boosting public transport; reducing gas flaring and leakage; changing land use; and an overall reduction in greenhouse gas emissions below business as usual (BAU). For example, Iraq will cut 90 million tonnes from 2020 to 2035, 14% below BAU (UNFCCC 2015a); Iran will cut 4% below BAU unilaterally and up to 12% with international aid (UNFCCC 2015b) and Morocco will cut 42% below BAU (UNFCCC 2015c). Carbon capture and storage is mentioned by the UAE, along with carbon sequestration in marine and coastal environments (UNFCCC 2015d). Saudi Arabia also mentions CCS (UNFCCC 2015e).

Within the MENA region, Climate Action Tracker assesses only three countries against their Paris goals: Saudi Arabia (rated Critically Insufficient), the UAE (rated Highly Insufficient) and Morocco (rated 1.5 °C Paris Agreement Compatible).¹⁴ In fact, Morocco is one of only two countries in the world rated so highly. Most MENA countries have major technical and economic potential for greenhouse gas cuts at relatively low (or even negative) cost, but sustained political will and commitment is lacking, though the region is far from unique in this regard.

MENA countries are themselves severely threatened by the effects of climate change, particularly given that most are already water-stressed and experience high temperatures. Urban development and important agricultural areas in coastal areas are threatened by sea-level rise and saline water infiltration. Weak regional states, and countries neighbouring MENA such as Afghanistan, Pakistan and the Sahel, may come under further stress as results of drought, desertification, groundwater depletion, upstream dams (notably on the Nile, Tigris and Euphrates), intensified summer heatwaves, interruptions and price spikes in world food trade, migration and other climatic impacts. These stresses may exacerbate the economic impact of falling resource rents (discussed below).

5.1.2 Peak Oil Demand

Recent years have seen growing attention to the concept of ‘peak oil demand’, that in the relatively near term, global oil demand will begin to decline, because of the expansion of electric vehicles, improvements in efficiency, environmental pressure on plastics and greenhouse gas emissions limits. Estimates for when this might occur range from the mid-2020s to the 2040s or even beyond (Fig. 4).

Yet, even the 2040s are not that far away, when it comes to the question of retooling an entire economy and MENA’s expensive and long-lived energy assets. MENA

¹⁴<https://climateactiontracker.org/countries/>.

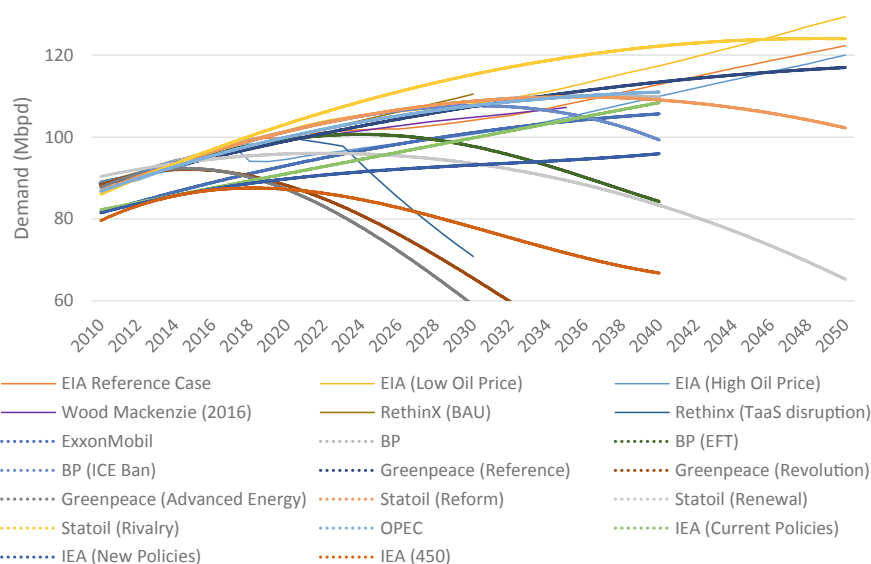


Fig. 4 Estimates for peak oil demand. *Source* International Energy Agency World Energy Outlook 2016; <http://corporate.exxonmobil.com/en/energy/energy-outlook/download-outlook-for-energy-reports>; BP Energy Outlook 2018; energy [r]evolution, Greenpeace <https://www.greenpeace.org/archive-international/Global/international/publications/climate/2015/Energy-Revolution-2015-Full.pdf>; Statoil; RethinX; Energy Information Administration; OPEC. RethinX does not give exact figures so they have been approximated from its graphs. Not all forecasts give figures for every year, so a smooth polynomial has been used to interpolate

national oil companies (NOCs) are aware of the peak oil demand question, but have generally not subscribed to the idea of an early peak, nor fully internalised its implications. The immediate pressure has been to survive the post-2014 period of ‘low’ prices, without the consideration that this might be a permanent state of affairs, or indeed that prices may be in a secular downtrend.

During 2015, Saudi Arabia and other producers substantially ramped up output to fight a ‘price war’ and gain market share, hoping to deter competitors. But non-OPEC production, particularly US shale, proved more resilient than expected. In 2016, they changed tack.

The ‘Declaration of Cooperation’ (OPEC 2016) in December 2016 between OPEC countries (in MENA: Saudi Arabia, Iraq, the UAE, Kuwait, Iran, Libya and Algeria; Qatar withdrew from OPEC in December 2018 (CNBC 2018)) and a group of non-OPEC producers, led by Russia and including Oman, Kazakhstan, Mexico and others, called for oil production cuts of about 3.5% by each OPEC country and lower cuts by the non-OPEC adherents to the ‘OPEC+’ or ‘Vienna Group’ pact. In the event, Saudi Arabia has substantially over-complied, Russia has under-complied, but the agreement has helped to raise prices and reduce excess inventories for now.

Even if US shale output slows into the 2020s, the question remains about the sustainability of this arrangement. Some other non-OPEC producers, such as Brazil and

new entrant Guyana, are expanding, while promising shale resources in Argentina, Australia, Russia and elsewhere are attracting interest. Given decline rates from existing fields, a substantial amount of new oil will be required even in a world of peak demand. Prices could be volatile on the way down, and there will still probably be price spikes triggered by phases of underinvestment or security problems.

The low production costs of most MENA countries mean they will still be able to generate rents, though at overall reduced levels. Long-term production restraint risks ‘stranding’ large quantities of viable resources, while keeping prices elevated makes both competing production and non-oil technologies more viable. But Fattouh and Dale argue that OPEC countries’ short-term budgetary needs mean they will be unable to pursue a high-volume/low-price strategy to maximise output and squeeze out competitors in the run-up to ‘peak demand’ (Dale and Fattouh 2018). Indeed, OPEC’s own 2019 World Oil Outlook (OPEC 2019) expects its production of oil and other petroleum liquids to fall from 35 million barrels per day (bbl/day) in 2019, to 32.8 million bbl/day by 2024. The economic impact on oil exporters is determined less by the exact date of the peak, which will anyway be visible only in hindsight, and more by the pace of demand growth prior to the peak, the absolute volume at peak and the subsequent rate of decline.

5.2 Value Generation, Internalisation and Demand Defence

In response to these pressures, the main MENA oil producers are following essentially two linked strategies. The first is to generate more value from their existing production. The second is to create new markets, or at least defend existing ones.

Investment in the oil upstream has become a lesser priority. In some countries, this is because of domestic political or security problems. In Saudi Arabia, it reflects a lack of space in the market for major production gains, particularly while the OPEC + quotas remain. ADNOC has plans for a substantial rise in capacity; Kuwait’s ambitious expansion plans have made little progress over the last couple of decades; while Iraq’s production capacity continues to grow despite bottlenecks. Iran is capable of maintaining production around current levels, diminished by sanctions, but significant growth would require international investment in a post-sanctions situation. Libya, too, would require several years of improved security and investment to regain its pre-Revolution level of 1.6 million bbl/day, or the aspirational 2 million bbl/day. Oil output in Algeria, Bahrain, Oman, Egypt and Qatar is in slow long-term decline unless there are major new discoveries, or investment in EOR or unconventional resources.

The Middle Eastern NOCs have invested relatively little in international upstream, because of their vast and low-cost domestic resources and, in some cases, lack of adequate technical and managerial skills. Kuwait Foreign Petroleum Exploration Company has been the most notable exception, building up a sizeable if scattered global portfolio. Mubadala, a sovereign wealth-type vehicle of the Abu Dhabi government, has made a smaller but more concentrated number of upstream investments

in Qatar, Oman, south-east Asia, Russia and Egypt. Recently, Qatar Petroleum has enjoyed overseas exploration success, in partnership with IOC supermajors, in South Africa, Cyprus and Guyana. But these projects remain small compared to domestic production.

So value generation has primarily come outside upstream oil. Value generation is not a new strategy—it dates back at least to the 1960s in Iran, the 1970s in Iraq and the early 1980s in Saudi Arabia—but has been pursued more vigorously and consistently in recent years. Saudi Arabia, mainly under Aramco and Saudi Arabia Basic Industries Corporation (SABIC), has been the leader, with ADNOC catching up under the leadership of Sultan Al Jaber (appointed CEO in 2016), along with sovereign wealth vehicle Mubadala (which took over the International Petroleum Investment Corporation (IPIC), another state fund, in 2017¹⁵). Qatar Petroleum, under CEO Saad Al Kaabi, also named energy minister in November 2018, has adopted a more aggressive domestic and international growth strategy, including taking over the stakes of IOCs in expiring Qatari fields. Kuwait Petroleum Corporation (KPC), Oman Oil Company and Sonatrach (Algeria) have been active, but to a lesser degree.

Part of enhanced value generation includes ‘in-country value creation’, trying to improve the capacity of local firms or joint ventures to supply the domestic oil industry with equipment. Eventually, this might produce internationally competitive oil services and engineering firms, as Norway has done. However, it runs the risk of protectionism and raising local production costs, and the skills developed have to be transferable to new sectors. Localisation—boosting the skills development and hiring of citizens instead of expatriates—has also been pursued. It can provide high-skilled, high-paid work but, given the low and falling labour intensity of the oil industry, will not make a dent in unemployment except in the smaller GCC countries.

The other part of value creation includes a move ‘downstream’—to refining, petrochemicals, tankers, storage, trading and fuel retail. This is taking place both at home and abroad. Aramco launched trading in 2012 (Saudi Aramco 2017), while ADNOC Trading was set up in 2018 (Arab News 2018), and the company has been promoting its Murban crude grade as a regional price benchmark (TheNational.ae 2019). With the launch of China’s International Energy Exchange’s crude oil contract in March 2018, there is also some pressure on the Gulf producers to ensure that control of their commodity’s pricing does not move to their main customer (WSJ 2019).

Petrochemicals are seen as one of the most promising areas for future oil demand, since demand typically grows faster than GDP in emerging economies, and alternatives such as biomaterials remain more costly and limited in supply. Producing petrochemicals releases some greenhouse gases, but the products themselves do not until and unless they decompose or are burnt. The Gulf has developed a large basic chemical industry, based mostly on previously flared gas, and using methane and ethane as feedstocks to yield fertilisers, methanol, polyethylene and polypropylene. Now, new petrochemical strategies focus on mega-scale integrated refining and petrochemical complexes, culminating in Aramco/SABIC’s proposed direct crude-to-chemicals conversion plant at Yanbu’ on the Red Sea coast. These offer improved

¹⁵<https://www.mubadala.com/en/mubadala-investment-company-old>.

margins and market adaptability but are much more complex to construct and operate. Speciality chemicals move up the value chain and can support local industries such as automobile components but do not have the previous feedstock cost advantage.

The second part of the strategy, demand defence and creation, overlaps with downstream development. Internationally, the particular focus has been Asia—the traditional markets of Japan and South Korea, now with China, India and others such as Pakistan, Vietnam and Indonesia. So far, there has been little attention to Africa, though this could change with growth in countries such as Ethiopia. Saudi Aramco has joint-venture refineries in China, Japan and South Korea, and it and ADNOC are exploring a giant greenfield refinery in western India with a consortium of Indian state firms.

Creation of gas demand has received less attention but is perhaps more powerful, given the competition between gas and coal in Asia, and the need for substantial infrastructure for importation and use. Qatar Petroleum has extended its LNG portfolio into the US. Qatar Petroleum is a majority owner (70%) of the Golden Pass LNG terminal in Texas, with Exxon Mobil (17.6%) and ConocoPhillips (12.4%) and is planning to invest \$20 billion in US conventional and unconventional oil and gas assets (Reuters 2018a). Algeria, by contrast, once a gas superpower, is struggling: its core European market is seeing low prices amid Russian and American competition, while exports are dropping because of underinvestment in new fields and rising domestic consumption.

Aramco and ADNOC, whose gas businesses today essentially serve only domestic demand (ADNOC has a relatively small LNG export unit), have targeted gas as a key growth area, as has Mubadala which was already a significant gas player via its 51% holding in the Dolphin pipeline. But this is more challenging for them than Qatar, as they have to enter a crowded international space rather than relying on a domestic surplus. Aramco has taken a stake in Semptra Energy's US Gulf Coast export facility (25% of Port Arthur LNG) (Saudi Aramco 2019) and has had discussions to enter Russia's Arctic-2 LNG project.

The northern tier of the Middle East may see the most development in gas, with a complex mix of commercial and political factors. Iran began exporting gas to Iraq in June 2017 (EIA 2019), although Baghdad has come under US pressure to find alternatives. The Kurdistan region of Iraq has large gas resources which could serve the crowded Turkish market, or the rest of Iraq. Iraq is gradually making headway on reducing gas flaring and boosting power generation; it could eventually link up to the GCC and become the gas and power conduit between Iran and the Gulf to the east, Turkey to the north and the eastern Mediterranean to the west.

But oil and even gas still have to contend with the climate imperative. Aramco is the most advanced of the region's NOCs in thinking about demand defence in terms of climate compatibility. It has invested substantial research and development funding to improve engine efficiency, including developing some radical new designs, which could keep oil-driven transport competitive with electric vehicles for longer, while reducing emissions. Its gasoline compression ignition technology has been accepted by Japanese carmaker Mazda Motor, and it is working with Achates Power on opposed-piston engines (PR News Wire 2018). These are said to be 30-50%

more efficient than conventional diesel and gasoline engines, have lower soot and NOx emissions than diesel and can run on low-octane gasoline (Green Car Congress 2018). It is also researching octane-on-demand to lower consumption and emissions of high-octane fuel used mostly during acceleration (SCMP 2019). Aramco has also worked on mobile carbon capture and storage for vehicles, though the economic viability of this seems doubtful. It has sought to develop non-metallic products from petrochemicals, such as oil-field pipes.

It touts the low-carbon footprint of its production (a result of low flaring, reducing methane leakage, improving energy efficiency of operations, and inherent advantages such as prolific reservoirs and limited water cut). This could become important as low-carbon fuel benchmarks are adopted by consuming countries and push out high-carbon crudes such as Canada's oil sands.

Aramco, ADNOC and QP have all launched large carbon capture and storage facilities, which inject carbon dioxide from gas processing or industrial facilities into underground reservoirs for safe disposal or enhanced oil recovery (EOR). Aramco is a member, and ADNOC considering becoming a member (Reuters 2017), of the Oil and Gas Climate Initiative (OGCI), along with leading international oil companies such as Shell and Occidental, with CCUS as a key focus.

In the longer term, two other technologies offer promise for sustainable hydrocarbon use. Direct air capture (DAC) extracts carbon dioxide from ambient air. It can then be used for improving plant growth in greenhouses, creating products such as low-emission cement, plastics or synthetic fuels, or injecting underground for EOR. As all realistic emissions paths compatible with limiting global warming to 1.5 °C or 2 °C involve substantial amounts of 'negative emissions', DAC could have a growing role, and MENA countries offer ideal geological, economic and social conditions.

Hydrogen has also attracted growing recent interest as a clean fuel. Its prospects for light vehicles appear doubtful, because of the major improvements of battery cars. However, hydrogen could be viable in long-distance trucking, ships and air travel. It is likely to be even more important for seasonal energy storage, balancing variable renewables, and for decarbonising heavy industry by providing high-temperature heat, and as a reducing agent such as in steelmaking.

'Blue hydrogen', made from fossil fuels with carbon capture and storage, or 'green hydrogen', produced by electrolysis with low-carbon electricity, both have promise in MENA. Japan has expressed particular interest in developing a 'hydrogen economy' that could include imports from MENA and other suitable producers such as Australia. Dubai has set up a pilot hydrogen electrolysis facility at its Expo site.

6 Retooling the Domestic Energy System

Most MENA countries are engaged, at varying paces, in restructuring their domestic energy—primarily electricity—sectors. This has primarily been driven by economic and security-of-supply, not environmental, imperatives.

Many regional countries struggled with limited gas availability during the 2000s, as the economic boom outpaced production or insecurity cut off imports. In Egypt, Iraq, Iran and Sharjah, this manifested itself in power cuts and interruptions of gas to industry. Exports from Algeria and Oman were limited by feedstock. Jordan, Saudi Arabia, Kuwait and the UAE burnt large quantities of expensive liquid fuels to meet power demand.

Sector reform has manifested itself around three pillars: reductions in subsidies, increased private involvement and greater use of non-hydrocarbon energy.

Exposure to world LNG market prices, whether as an importer or exporter, has helped set an upper benchmark for local gas prices and encourage reduction in subsidies. Dubai, in 2008 (Boersma and Griffiths 2016), and Iran, in 2010 (IMF 2011), were two of the first to begin significant reforms of electricity, gas, water and petrol/diesel prices, and most regional countries have since followed suit. This has restrained demand growth, though it is difficult to isolate the exact impact because of the concurrent economic slowdown from 2014 onwards.

The breadth and social acceptance of the reforms differs from one country to another in the MENA region; nevertheless, energy prices are generally still below international or fully cost-reflective levels and in some cases reform has been postponed or cancelled due to lack of parliamentary support (seen in Iran, Bahrain and Kuwait). In some cases in the GCC, particularly Saudi Arabia, and in Iran, rises in energy prices for the consumer were followed by a cash transfer programme or other type of in-kind assistance by the government, to help protect lower income citizens and to minimise any risk of civil discontent.

Independent power producers (IPPs) have been introduced from the early 2000 s onwards in most regional countries, breaking the model of the vertically integrated, state-owned monopoly utility. However, privatisation of distribution has remained very limited, and true electricity markets do not exist, with the 'single buyer' model persisting and a state monopoly remaining in charge of transmission. Oman has made some steps towards a more liberalised power market especially once it has opened private sector participation in electricity and water production. The GCC country also plans to privatise its transmission and distribution companies by selling up to 70% of its stakes in Muscat Electricity Distribution, and 49% of its stake in the Oman Electricity Transmission Company by 2020. Plans will likely be delayed due to their complexity (Reuters 2019a). Improvements in dispatch, and the replacement of outdated plants, have gradually improved average fleet thermal efficiencies. But identifying the true cost of electricity, and the true value of different sources of generation, remains difficult.

6.1 Alternative Energy Sources

The emergence of alternative electricity generation is the most striking and, in the long term, consequential of these changes. Over the next one to two decades, the use

of oil in the MENA power system is likely to be largely phased out, while growth in gas use in power slows sharply.

These alternatives to hydrocarbons include coal, nuclear and renewables.

6.1.1 Coal

The turn to coal clearly illustrates the prioritisation of security-of-supply and economic motivations over environmental ones, even if some of the coal plants are promoted as ‘carbon capture-ready’. It, and nuclear, indicates the preference for large, centralised facilities under the firm control of the national utility. There is no coal mining in MENA (outside a small amount in Iran¹⁶), so the use of domestic resources, or the preservation of domestic employment, is not a factor as it is in parts of Europe, the US, India, China or South Africa. But coal is cheap and readily available from a range of suppliers (US, Australia, South Africa and Indonesia) who do not bring the same security-of-supply concerns as some oil and gas exporters.

This explains the interest in coal from Dubai, Egypt and Morocco, and its historical use in Israel. Cement plants in Egypt and the UAE have turned to coal to replace expensive or unavailable gas or fuel oil. Dubai is constructing a large (2.4 GW) ultra-supercritical coal-fired power plant at Hassyan in the south of the emirate (Arabian Industry 2018). Egypt’s plans for a sizeable clean coal power plant (2640 MW) with Chinese and Emirati backing were apparently called off by the Egyptian Ministry of Electricity in 2019 (IEA Clean Coal Centre 2019). Conversely, coal use in Israel is being replaced for environmental reasons by its new offshore gas, and renewables in Morocco will erode the share of its coal plants.

6.1.2 Nuclear

Nuclear power is more complicated, and the timelines and motivations of each country vary. Nuclear power globally has been struggling to maintain its share of the energy mix, due to the shutdown of old plants, nuclear reductions or phaseouts in countries such as Germany over safety concerns following the 2011 Fukushima accident in Japan, and the high cost and long timelines for new builds. The MENA region, though, had no operating nuclear power plants (there were some small research reactors) until recently but has now emerged as a relative bright spot for the industry.

Iran has one operational plant, 1 GW at Bushehr, on the Gulf, which came into service in 2011 (The Japan Times 2019a) after originally starting construction in 1975. Nuclear power has been seen as a source of national pride and technological advancement (Vaez and Sadjapdour 2013). In the 1970 s, there was a fear that Iran’s oil resources would be exhausted relatively quickly; in the 2000 s, the concern was over the lagging pace of gas field development compared to fast-rising consumption. Now,

¹⁶Turkey, not included here in MENA, has substantial lignite mining and has made it a core part of electricity diversification.

an increase in gas output makes this less of an immediate worry, but the programme has a momentum of its own. In November 2019, Iran began construction on another 1 GW reactor at Bushehr (DW 2019), with Ali Akbar Salehi, head of the Atomic Energy Organisation of Iran, commenting that each reactor would save 11 million barrels of oil annually (a reasonable figure assuming that nuclear power solely displaces oil).

The link to the country's uranium enrichment programme is not straightforward, since Russia is supplying the fuel for Bushehr, though Iran does have ambitions to construct additional, domestically designed reactors. The US-led sanctions under the Obama administration were specifically predicated on limiting the country's enrichment, given that this could eventually produce weapons-grade uranium, not on the civil nuclear power programme per se. The full scale of Iran's nuclear plans might reach 10 GW by 2035,¹⁷ out of a total installed capacity of some 137 GW, generating some 20% of the country's power. However, likely nuclear capacity will be much less than this, and the high cost and long construction times contrast with the relative ease and cheapness for Iran of turning to modern solar and wind.

In December 2006, the GCC states announced they had commissioned a study on civil nuclear power. Of these, Kuwait explicitly ruled out nuclear in July 2011 following Fukushima in March 2011, but Abu Dhabi had already begun a nuclear power programme in 2009 with the award of the construction bid to a consortium led by Korea Electric Power Company (KEPCO) and involving Samsung, Hyundai, Doosan and Westinghouse. France's Areva, with Suez and Total, competed intensely with the Korean consortium for the contract, given the importance of their plans to develop export-oriented nuclear power industries. Originally, the first of four reactors, totalling 5.6 gigawatts (GW), was intended to start in 2017, but construction and training delays have pushed full commercial operation back probably to 2021.

Its use of nuclear power was predicated on the country's rapidly growing electricity consumption, the struggles of gas production to keep up with demand, the lack of progress on expanding the Dolphin gas import contract with Qatar and the relatively high cost of alternatives, including renewables. Subsequently, demand growth has slowed, domestic gas output is set to rise, and solar power in the UAE has achieved dramatic gains in size and cost-competitiveness. Therefore, the UAE Energy Strategy 2050 counts nuclear as part of its 'clean' energy (i.e. zero-carbon) target but does not foresee that any more reactors will be constructed by 2050. Greenhouse gas emissions were not an important part of the initial motivation for the programme but have been claimed retrospectively.

Saudi Arabia has had a number of abortive plans for nuclear power, with a programme announced in August 2009. In April 2010, the King Abdullah Centre for Atomic and Renewable Energy (KA.CARE) was established, and during 2011-2016 it produced various targets, for between 16 and 17 GW of reactors, and signed study agreements with GE Hitachi Nuclear Energy, Toshiba/Westinghouse, Exelon, the Korean Atomic Energy Research Institute, China Nuclear Engineering Corporation and Rosatom. Plans included full-scale reactors as well as small modular reactors

¹⁷ Author's estimates.

integrated with desalination. Saudi Arabia has also sought to mine its domestic uranium resources.

As with renewable energy, KA.CARE's intentions were stymied by turf wars with the energy ministry, and its own lack of ability to finance plants. However, from 2017, nuclear plans appear to have revived under the Ministry's banner, with a framework agreement with the International Atomic Energy Authority, selection of two reactor sites and the start of construction on a 30 kW research reactor at Riyadh.

Jordan has long investigated nuclear power because of its lack of domestic oil and gas resources, and its uranium resources (in phosphate deposits which are difficult to extract (World Nuclear Association 2019)). It has set up a Committee for Nuclear Strategy in 2007, and it set out a programme for nuclear power to provide 30% of electricity by 2030. The shut-off of Egyptian gas supplies due to sabotage and falling production after 2011 gave further impetus to its search for energy security. But its small electricity market would find it hard to accommodate a large reactor, and the relatively poor kingdom would struggle to finance it. With a short coastline, cooling water is not readily available (the inland Al Amra site chosen in 2010 was to be cooled with water from the Khirbet Samra wastewater treatment plant (World Nuclear Association 2019)). With the new availability of regional gas, the development of its indigenous oil shale, and the expansion of Jordan's successful solar and wind programmes, nuclear power is unlikely to proceed.

Egypt is a more promising case given the large and fast-growing domestic electricity market. Again, nuclear power plans have been floated for many years, with a 150 MW nuclear plant being proposed as early as 1964, but have been repeatedly stalled. In 2004 and 2008, Egypt signed new nuclear cooperation agreements with Russia's Rosatom for a 1 GW nuclear reactor, but lack of action forced a renewal of the cooperation agreement in 2013. In 2015, a new agreement was signed with Rosatom to finance and build four 1.2 GW reactors at El-Dabaa on the Mediterranean coast (World Nuclear Association 2020).

The high cost and technical sophistication of nuclear power programmes raises the question of the motivations for pursuing them, beyond simple economic and environmental goals.

The UAE signed a '123' agreement with the US, giving it access to American nuclear suppliers, which committed to a 'gold standard' on regulation and transparency, including a commitment not to enrich uranium or reprocess nuclear fuel. This was an important part of assuaging concerns that a civil nuclear power programme could be a cover for a weapons programme, given the US objective to prevent further proliferation, and in particular any threat to Israel's regional monopoly on nuclear weapons. The UAE's agreement, though, does give it the right to match the conditions offered by the US to any other regional state in subsequent agreements. Although there is no sign that the UAE's power programme is intended to be part of 'nuclear hedging', it could develop skills that might eventually be used for that purpose. Perhaps, more significantly, it creates a large and high-profile asset, and long-term agreements with a variety of influential countries, which would encourage them to come to the UAE's aid in the event of a threat.

Saudi Arabia has not signed a '123' agreement, partly because of its desire to retain the option for domestic enrichment of its uranium resources. It has, however, been lobbying for US support of its programme. Its leadership has given ambiguous signals on proliferation (though it is party to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), and has a Comprehensive Safeguards Agreement with the International Atomic Energy Agency (IAEA)), with crown prince Mohammed bin Salman noting that Saudi Arabia would seek to acquire nuclear weapons if arch-rival Iran did so (Reuters [2018b](#)).

6.1.3 Renewables

In contrast to the decentralised renewables models pioneered in Europe, and being promoted for African countries, MENA countries have preferred to introduce large-scale centralised renewable projects. These have typically been awarded by tender by the state-owned utility, ministry or energy regulator, with an offtake guarantee. Land is usually free and grid connections often provided. Commercial banks have proved willing to finance these projects up to 84-90% of project value at low rates, enabling world-record levelized cost of energy (LCOEs) to be bid. Dubai, Abu Dhabi and Saudi Arabia have set records in solar photovoltaic (PV), Dubai in concentrated solar thermal power (CSP) and Saudi Arabia in onshore wind. Oman, meanwhile, has inaugurated a giant solar thermal project to provide steam for enhanced recovery of heavy oil.

The less creditworthy countries, notably Jordan, Egypt and Morocco, have not achieved such low bid prices, but nevertheless they have made impressive progress, at costs well below that of burning oil or imported LNG. Morocco, in particular, has been a regional leader in CSP through its renewable agency MASEN.

Acwa Power, a private Saudi company held 45% by the Public Investment Fund (PIF) (Al-Monitor [2019](#); Reuters [2019b](#)), and Masdar, the clean energy subsidiary of Mubadala, have emerged as regional leaders. Chinese, Japanese and European companies (such as Jinko Solar, Marubeni Corporation, French energy giant EDF) have also been well-represented among winning consortia. For instance, Abu Dhabi's 1.17 GW Noor Abu Dhabi Solar Plant is a joint venture between the Abu Dhabi Government and a consortium of Marubeni Corporation and Jinko Solar Holding.

Progress is patchy across the region, though some of the laggard countries are now catching up. Saudi Arabia struggled from turf wars between the King Abdullah Centre for Atomic and Renewable Energy (KA.CARE), and the Ministry of Energy; and more recently between the ministry's Renewable Energy Project Delivery Office (REPDO) and the PIF (Power Technology [2019](#); Bloomberg Environment [2019](#)). Iran has some domestic capability but struggles to attract international investment under the burden of sanctions and its own opaque domestic environment. It has, though, carried out a large programme of hydroelectric dam construction, problematic under drought conditions and part of a wider struggle to meet local water needs for agriculture and ecology. Iraq struggles to offer acceptable payment guarantees

and to overcome its internal bureaucracy, but a recent offer of 755 MW solar PV¹⁸ is encouraging. Qatar, with its abundant low-cost gas, has not prioritised renewables but has tendered for a 700 MW solar PV project, which could be expanded to 800 MW, to be operational by the fourth quarter of 2021 (PV Magazine 2019a).

Perhaps more surprising is the slow progress made in Oman, Bahrain, Kuwait, Lebanon and Algeria to date. These countries have struggled with combinations of domestic gas shortfalls, reliance of the power sector on high-cost oil or imported LNG and reductions in gas exports because of lack of feedstock. Idiosyncratic factors are at play, though with some common elements.

Oman, for instance, struggled with a lack of institutional capability, though it is now picking up on a series of renewable projects and recently commissioned its first wind farm. Lebanon's power sector has been hampered by politicisation, corruption and heavy losses from selling subsidised power, though there are tentative signs of recent progress. Poor public services, including lack of electricity, was a major factor behind the October–November 2019 protests (Reuters 2019c). Kuwait's energy projects in general have been badly delayed by continual gridlock between the government and parliament, with MPs wielding allegations of corruption.

Some countries, notably Saudi Arabia and Morocco (Oxford Business Group 2018), have sought to drive local economic development through renewables by specifying local content requirements. The UAE, by contrast, has focussed on achieving the lowest possible costs.

Alongside the large utility-scale projects, 'rooftop' and distributed renewables have made progress in some cases where the regulatory framework has been supportive. In particular, net metering programmes in Israel (PV Magazine 2018a), Jordan (PV Magazine 2018b), Abu Dhabi, 'Shams Dubai' (with 106 MW installed as of September 2019) (PV Magazine 2019b) and the Sahim scheme in Oman¹⁹ have provided relatively attractive economics for larger scale (industrial and large commercial) installations. Despite subsidy reform, residential power prices in the region are still usually too low to encourage householders to install rooftop panels. However, solar water heaters have been mandated in Dubai and are popular in Jordan and Israel (Green Tech Media 2018).

Renewable power also raises the need and potential for electricity trading within MENA countries, such as the GCC, which has a pre-existing interconnection grid. Large-scale wind, solar PV and CSP projects would support expansion of the grid's current capacity (2.4 GW) and potential extensions to neighbouring countries. For instance, Iraq's Ministry of Electricity recently signed an electricity purchase agreement of up to 2 GW with the GCCIA, the leading advocate for regional power trading. Iraq shall receive power supplied by GCC countries (Kuwait, Saudi Arabia, and the UAE) from transmission lines from Kuwait. Saudi Arabia was in talks with Iraq last year for providing electricity from a 3 GW solar plant at a steep discount compared to what it imports from Iran (\$21/MWh against \$84/MWh from Iran), while Egypt

¹⁸<https://moelc.gov.iq/index.php?name=News&file=article&sid=4558>.

¹⁹<https://www.aer.om/en/sahim>.

has shown interest in a linking its national grid with Saudi Arabia's to meet peak demand with imports (up to 3 GW) (APICORP 2018).

Countries that have successfully developed large amounts of variable renewables may seek to export surpluses at certain times to their neighbours. They may also rely on dispatchable capacity in other countries to reduce their need for balancing variable renewables. And time differences across the region can be exploited; for instance, solar power in Jordan or Egypt can cover for demand in eastern Saudi Arabia during the early evening there. However, large-scale electricity exports from the region to Europe are unlikely in the medium term. From the Middle East, they would have to cross unstable areas in Syria or Lebanon. From North Africa, the distance is shorter and easier but the investment climate in Algeria and Libya has been unfriendly, and all the North African countries have been prioritising meeting their own demand. Europe would also, for reasons of local employment and security of supply, not wish to depend too heavily on its Mediterranean neighbours. Electricity exports from the GCC to South Asia via undersea cables could be a possibility. But the EU preference is likely to be more for imports of decarbonised industrial materials, such as steel, aluminium, fertilisers, cement and hydrogen, made in MENA with renewables, and fossil fuels with CCS (van Wijk and Wouters 2019).

Renewables are unlikely to perpetuate the 'rentier' model or contribute to the 'resource curse'. An attractive investment model is required to make MENA renewables competitive against neighbours, given the intense competition to lower financing costs. Although MENA has some of the world's best solar conditions, they are not superior enough to generate large rents, when including long-distance transmission.

7 Shifting Strategies in the Geoeconomic Transition

The US has since the 1970 s been by far the dominant outside power in the Middle East (if not so much in North Africa), replacing or expelling the Soviet Union as the sponsor of several client regimes. The Carter Doctrine, promulgated in 1980, declared that the US would use any means, including military force, to prevent outside domination of the Persian Gulf,²⁰ a warning squarely directed at the USSR following its intervention in Afghanistan. Though the Carter Doctrine was not directed at regional states, the US has also sought to prevent the rise of a regional monopolist which might dominate Middle Eastern oil supplies, leading the coalition to expel Saddam Hussein's Iraqi forces from Kuwait in 1991.

Though direct US imports of Middle Eastern oil have been relatively modest (Venezuela, Mexico and Canada being more important suppliers), this role has been played in recognition of the centrality of secure and reasonably priced energy to US allies in Western Europe and East Asia, notably Japan and South Korea. Another

²⁰<https://www.presidency.ucsb.edu/documents/the-state-the-union-address-delivered-before-joint-session-the-congress>.

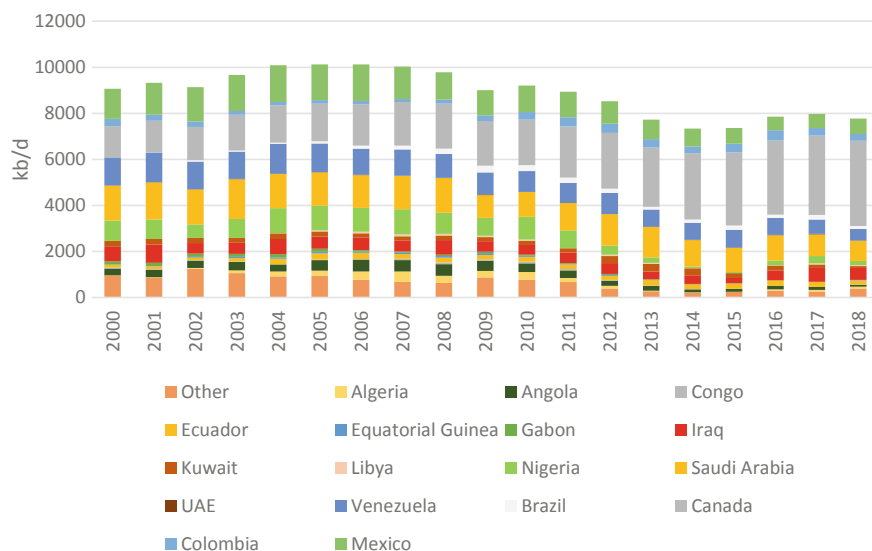


Fig. 5 US oil imports by country

objective, usually implicit, has become the most salient in recent years: the ability to deny oil in the event of conflict to US rivals, specifically China.

However, over the past two decades, even though US military forces in the Middle East remain strong, that role has gradually eroded. As the US has moved towards being a net exporter of oil, its imports from MENA have plunged (Fig. 5). The long wars in Iraq and Afghanistan, and the chaotic aftermath of the intervention in Libya, have drained domestic appetite for continuing involvement. The recent blundering withdrawal from parts of north-eastern Syria is symptomatic of this desire, and of the lack of a clear articulation of the continuing and compelling strategic rationale for remaining. Meanwhile, the US's main regional partners have been alarmed by its unpredictability, and have begun to take some steps to diversify their dependence on its security and diplomatic cover.

The key rising players have been China and Russia, China more in the economic sphere, Russia in the military and diplomatic. **Russia** has extended cooperation with various Middle Eastern countries, often across contradictory geopolitical alignments. Though it has given Iran diplomatic support in the sanctions standoff with Washington, it has not been able—or has not tried particularly hard—to shield Iran, an oil market competitor, from the consequences.

The OPEC + agreement has deepened the relationship with Saudi Arabia, making Moscow an oil market player that cannot be ignored. For the first time, Russia has delivered on production curbs—though it has not committed to cut as much as the OPEC countries, nor has it fully implemented those cuts. Russia's influence was also been important in convincing Iran to join the accord in December 2016 (Reuters 2016), though Iran now chafes at Saudi-Russia domination of OPEC policy. As a

relatively high-cost producer, with more limited reserves than the main Gulf countries, and whose production was rising only slowly, Russia benefits more from the limitations. Its relative gains will be even more significant should oil demand growth slow or reverse in the near future.

Russian companies' investments in the region remain relatively limited, but Lukoil, Rosneft and Gazprom Neft have important assets in Iraq. Gazprom has long been involved in Libya, and Lukoil recently entered Abu Dhabi's offshore sour gas project. Rosneft entered the Kurdistan region of Iraq in September 2017, just ahead of the ill-fated referendum on independence which led to the loss of Kurdish control of the Kirkuk region and its important oil production. Rosneft signed for various oil-field developments, bought a stake in the main oil export pipeline through Turkey and agreed to construct a large gas pipeline to Turkey. However, its strategy in the area, whether as a competitor or a complement to compatriot Gazprom, is unclear.

Rosneft also bought a stake from ENI in the giant offshore Zohr gas field, while LNG player Novatek is involved in exploration in Lebanon. Russian companies, such as Kremlin-linked Sroytransgaz, hope to benefit from resources in Syria as a reward for supporting the Assad regime (Financial Times 2019). Though Gazprom Neft, Lukoil and Zarubezhneft have studied fields in Iran, none has been willing to invest under the penalty of American sanctions.

Nuclear power, via Rosatom, is another important area of cooperation. As discussed, Russia competed the long-moribund Bushehr reactor in Iran, has agreed to construct the Dabaa plant in northern Egypt (ROSATOM 2019), has been involved in Jordan's plans (now unlikely to progress) (Reuters 2018c) and discussed participation in Saudi Arabia's nuclear power programme (S&P Global Platts 2019). It is also constructing the Akkuyu plant in Turkey. Rosatom's integration across the nuclear value chain, its worldwide experience and its lack of political limitations give it advantages over its American, French, Chinese and South Korean competitors.

Overall in the region, Russian firms bring some reasonable technical skills and are desired for the diplomatic diversification. But they are not rich in capital, nor do they come with the vital domestic energy markets of the main Asian players. This will continue to limit them to a secondary role in the region's petroleum industry.

Some energy investments have gone the other way. These are not very large as yet, but Moscow does have an objective to replace the Western capital deterred by sanctions imposed over its annexation of Crimea in 2014, and not to become too dependent on Chinese funds. In 2018, Mubadala purchased a 44% stake in a unit of Gazprom Neft's operating fields in the Omsk and Tomsk districts of West Siberia (MUBADALA 2018). Saudi Aramco has explored the purchase of a 30% stake in Arctic-2 LNG from Novatek (Reuters 2019d). But the limited technical synergies and the barriers of political risk and lack of transparency that have held back foreign investment in general will probably limit the scope for Middle Eastern investment in Russian petroleum.

China has been a more important economic player. After playing second fiddle to Russia since 2017, Saudi Arabia has regained its slot as the country's largest crude oil supplier; Iraq is third, Oman sixth, while Iran was seventh in 2018 but has fallen to low levels (though China is now essentially its only paying customer). The MENA

role in gas is less dominant, with China relying on pipelines from Central Asia, Russia and Burma, but Qatar was its second-largest supplier of LNG with 13.1% of the market in the first nine months of 2019; Oman and Egypt supplied small amounts.

Its large state oil firms have gained in prominence over the past decade, particularly in their leading role in Iraq, acquiring assets in Egypt (Egypt Today 2017), and more recently by acquiring stakes in Abu Dhabi's renewed concessions.

In return, China has become the largest exporter of manufactured goods to most of the Middle East. It has been the leading representative of Iran's few remaining trading partners and investors, and has defended the JCPOA. But it has not been willing to oppose US sanctions too vigorously, given the practical difficulties, and the fact this is just one issue in a wider confrontation with America over trade and other contentious topics.

China's Belt and Road Initiative (BRI) relates to the Middle East, particularly the maritime route through the Indian Ocean to the Arabian Sea, Red Sea and Suez Canal (Gurol and Shahmohammadi 2019). The Caspian route through Iran, the Caucasus and Turkey to Europe is also important, while the Gulf has played relatively less of a role (Mills et al. 2017). The BRI's primarily economic goals still bring with it diplomatic, strategic and perhaps military obligations and opportunities.

China's diplomacy has been relatively low-key and it has not established a significant regional military presence, wishing to avoid any direct appearance of challenging the US (Lons et al. 2019). However, it has a base in Djibouti, close to the Bab El Mandeb exit from the Red Sea (The Diplomat 2018), and Chinese military analysts have argued for extending this network of bases to the UAE and Pakistan (Duchâtel 2019). The Chinese-developed Gwadar port in Pakistan is close to the egress from the Gulf (and to the Indian-backed port at Chabahar in the strategic southern Mokran region of Iran). Beijing has sought to remain neutral in the region's conflicts, maintaining good relations with Saudi Arabia, the UAE and Israel (Efron et al. 2019) as well as Iran. At some point, though, as its regional interests deepen, it may find itself in a situation where this neutrality cannot be maintained.

India too has traditionally been more of an economic player, but the recent flurry of deals signed with ADNOC and Saudi Aramco have moved it up the league table of key Middle East partners. Less geopolitically intimidating than the Chinese but less risk-averse than the Japanese and Koreans, it has also seemed a more promising long-term market as Chinese growth has slowed. Early in 2019, ADNOC signed an oil storage agreement with the Indian Strategic Petroleum Reserves (ISPR) to store 5.86 million barrels of Abu Dhabi oil, which was followed by ONGC Videsh, Bharat Petroleum and Indian Oil Corporation (IOC) being awarded stakes in Abu Dhabi's production licenses. Aramco has planned a \$60 B refinery and petrochemicals complex in India.

India has not yet played the diplomatic and security role in the Middle East its proximity, contribution of migrant labour, and elements of shared culture, history and religion might suggest. In September 2019, it deployed warships to protect its tankers in the Gulf area following a spate of attacks on tankers blamed on Iran (The Economic Times 2019). The US has at some times attempted to cultivate India as a counterweight to China (Janardhan 2019), which could eventually include a

heightened military role in the Gulf, as it did in the time of the British Raj (Gupta 2019).

Japan and **South Korea** are long-time economic partners of the Middle East, and particularly the Gulf, as importers of hydrocarbons and providers of manufactured goods and engineering services. They have increased their upstream investments in the region recently, particularly in Abu Dhabi and Iraq. Japan considered in September sending military forces to the Gulf to safeguard shipping, but this was opposed because of fears it would violate restrictions on the overseas deployment of the Self-Defence Forces (SDF) (The Japan Times 2019b). Ultimately, both will probably be too concerned about their immediate neighbourhood and the threat from China to commit large forces to the Middle East.

Europe's economic and diplomatic relationship with North Africa is more significant than with most of the Middle East, with France and Italy, and to a lesser extent Spain, especially involved as investors and customers. France and Italy have at times been at cross purposes in the civil war in Libya. The UK and France, in particular, have deepened their military and economic engagement with some members of the GCC, which has been welcomed as a counterbalance to worries over declining US attention. On the other hand, the 'E3' (UK, France and Germany) have been the leaders of the attempt to preserve the JCPOA with Iran in the face of the US violation of it, despite the GCC's dislike of the agreement.

The prospect of a transition to lower oil demand raises the question of whether the MENA region's geopolitical importance will decline. It will still, of course, have a central geographic position. Its gas exports, mostly from Qatar but possibly in future also from Iran, are expected to remain important for a longer period than for oil. Declining exports from Algeria and political instability in Libya have reduced their role as suppliers of gas to Europe, thus increasing the relative share of Russian gas, long an issue of concern for EU policymakers, though somewhat ameliorated by the rise of renewables and the increasing availability of LNG from diverse sources. However, in the short and medium term, the economic damage and instability from declining hydrocarbon rents could lead to a greater prominence for Middle Eastern political events. A secular decline in prices could be periodically interrupted by supply disruptions and temporary price spikes, which would themselves hasten the move towards alternatives. However, if the MENA region can avoid severe political upsets, it could even gain in geoeconomic importance for a while, as high-cost oil and gas producers are squeezed out of the market, and MENA exceeds the 42% share of world oil production it held in the early 1970 s, before the first oil shock.

8 Conclusions

The global energy transition centres on the shift from carbon-based energy sources and carriers to low/zero-carbon or decarbonised forms. Initially driven by environmental goals, this transition is now strongly encouraged by the growing cost-competitiveness and technical performance of many new energy technologies, particularly solar, wind, batteries and electric vehicles. However, hydrocarbons have also improved in cost, abundance and environmental performance in recent years, notably in the expansion of US shale oil and gas production, and the growth of the global LNG business.

From the MENA point of view, this energy transition coincides and partly overlaps with a geopolitical and geoeconomic transition. This involves severe political instability in many regional states; a diminished and less predictable role for the US and a rising position for Russia, China and some other states, which does not yet compensate for the American regress; and an ongoing shift of key markets away from the US and Europe towards emerging Asia.

The major MENA hydrocarbon exporters have, on the whole, coped with the fall in oil and gas prices since 2014, though with some economic difficulty and painful restructuring. So far, OPEC, with the new cooperation with Russia, has not just survived, but gained in coherence, given the stronger position of Saudi Arabia and its allies. But if oil demand growth continues to be weak or reverses, and/or non-OPEC competition remains strong, the loss of market share (or at least, failure to gain market share) will increase tensions between the OPEC + group's members.

Several leading MENA countries have found reasonable success in strengthening their hydrocarbon sectors to cope with new challenges, making their national oil companies more commercially minded and competitive, developing value-added trading, petrochemical and refining industries, and in particular in reorienting their markets towards Asia. Qatar has played its role in reshaping the world LNG business, and in adapting to the changes spurred by the appearance of US LNG exports. Some elements of a future climate-compatible industry are emerging—including a greater focus on petrochemicals and non-metallic materials, CCS, direct air capture and hydrogen—but remain quite nascent. The GCC countries in particular need to be bolder in investing in commercial-scale decarbonised projects.

Although their carbon footprints and levels of energy intensity remain very high by world standards, some regional states have also made increasingly swift and impressive progress towards integrating new energy into their domestic supply. Morocco, Jordan and the UAE stand out particularly. The dramatic new cost-competitiveness of solar PV, and improvements in wind and solar CSP, should see them rapidly gain a significant position in the energy sector of most MENA countries. Policy and government will and capability is catching up but still lags behind.

Some of the GCC states have made progress towards diversification and articulating 'post-oil' economic visions. So far, these do not involve a radical rethink of political and social systems. Iran, under the pressure of sanctions, has been forced towards diversification, though its economy has other severe structural flaws. Other

major hydrocarbon producers, such as Algeria, Libya and Iraq, have been unable even to begin on serious economic reform. The challenge of moving to an economy not heavily dependent on oil and gas revenues within one to two decades remains enormous. Though states such as Dubai, Malaysia and Norway offer some lessons, there are almost no regional or even global success stories that MENA countries could emulate, meaning they will largely have to find their own path.

Success in these three endeavours—retooling domestic hydrocarbons, boosting the new energy economy and diversifying economically—will be essential for MENA states to cope with the wider geoeconomic transition. So far somewhat passive consumers of the transition, they need to take a more active role in developing and deploying the key technologies and business models, and translating these into an effective, proactive and positive role in climate diplomacy. The institutions built up during the resource-rich era have strengths, but also serious rigidities that will hinder reform towards the post-oil era. Some have made significant progress in strengthening and widening their diplomatic relationships, remaining close partners of the US while dealing successfully with Russia, China, European and other Asian countries. Others have already been torn apart when their domestic political fractures have been exploited by outside powers. The future for resource-rich MENA economies, and their energy-poor neighbours and co-dependents, in an era of energy transformation is not as uniformly gloomy as the early scholarship has painted it. But it will certainly not be easy, and not all states will achieve the transition successfully, or even survive.

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