

# Energy in Transition

MENAT's Transformation: Vol 1, 2019



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# Collaboration is Key

**GARETH THOMAS**  
Regional Head of Global Banking  
Middle East, North Africa and Turkey (MENAT), HSBC



products and collaborations in the Middle East, a global pioneer in the energy transition, are rapidly growing (see: Progress Report). For example, thematic investment funds known as 'Electric Revolution' and 'Clean Living' that have been developed by HSBC Private Banking are now available to HBME clients. We also have an internal sustainable finance agenda that has created two lower-carbon funds that are both available in the Middle East: Global Lower Carbon Equity and Global Lower Carbon Bond. Both are registered with the UAE Federal Securities and Commodities Authority.

As we enter the largely unexplored territory of green growth, limitless potential awaits sustainable finance. Working together will enable all to safely, efficiently and innovatively break through new intellectual and geographic boundaries; a collective win-win.

Mastering a path is key to realizing the value of sustainable finance and we have identified two main drivers - new policies and access to financial architecture - that provide a reliable, creative and voluminous stream of funds to transform energy transition blueprints into reality. We believe that only transparent and collaborative efforts between all parties involved - notably financial institutions (FI), industry, government and academia - will ensure smooth travels on the

much-needed journey towards a healthier and more prosperous planet. And very importantly, energy security for all.

Creative, committed and world-leading: these best describe HSBC's approach to sustainable finance in the Middle East and wider region. We are building our reputation as the leading bank for sustainable finance, by providing the market with sustainable loans and advisory services across the lines of business and industries. The array of

## Sustainable Finance Pillar

HSBC is a leading global partner to the public and private sectors in the transition to a low carbon economy. We have made significant progress on our 5 global sustainable finance commitments (as part of our Sustainable Finance pillar) in 2018:

1. Provide \$100 billion of sustainable financing and investment by 2025: \$28.5bn achieved in 2018
2. Provide 100% electricity from renewable sources by 2030, 90% by 2025; 29% achieved in 2018
3. Reduce exposure to thermal coal and manage transition for high carbon sectors: New energy policy effectively ends new coal, tar sands and Arctic oil financing
4. Adopt recommendations of Task Force on Climate-related Financial Disclosures (TCFD): Global assessment of our exposure, reporting and disclosure
5. Lead and shape the debate around sustainable finance: 25 reports published in HSBC's Centre of Sustainable Finance, the bank's new thought leadership center

For any enquires, please contact:  
Diako Makhmalbaf  
Senior Manager - Sustainable Finance MENAT, HSBC  
Phone +971 4 423 5609  
Mobile +971 50 419 8628  
Email diako.makhmalbaf@hsbc.com



## HSBC Progress Report Middle East, North Africa & Turkey

### 2018

The HBME Climate Business Council (CBC) was established in February 2018 to bring together leaders across HBME and from all jurisdictions to ensure the bank meets its sustainable finance targets, develops a strategy for this region and responds to client needs. And the Sustainable Finance Growth Accelerator was established in January 2019, chaired by the Head of Global Banking, to spearhead a key focus for this genre of funding for growth in HBME.

### 30

HBME was amongst the first signatories to the Dubai Declaration for Sustainable Finance, an Initiative from the Ministry of Climate Change and Environment (MOCCA). In December 2018, HBME hosted over 30 representatives of the finance community and MOCCA to discuss new innovations in sustainable finance.

### 25

In January 2019, HBME was a signatory to the Abu Dhabi Sustainable Finance Declaration, along with 24 other public and private sector entities. HBME will provide support to the Central Bank of the UAE, the Securities and Commodities Authority and the Abu Dhabi Global Markets (ADGM) on facilitating investment flows towards sustainable and green outcomes.

### 20

The C3 Accelerator Program was launched in September 2018 as an open invitation to entrepreneurs making a positive social impact across the Middle East. Twenty finalists were selected and provided a week of training with impact investors from the social enterprise world at HBME headquarters in Dubai. The program ended with a pitch competition, encompassing senior experts from Facebook, Amazon, Google, MBC, Bain & Co,

MasterCard, Careem, MAF, GE, Lazard, IFC, Expo 2020 Dubai and Mubadala.

### 10

Sharakah and HBME signed a pact to support SMEs in Oman in January 2019 to provide support for sustainability integration for ten small and medium-sized enterprises (SMEs) - an integral and rapidly growing part of the sultanate's workforce.

### 40%

HBME has played an active role in capability development on sustainability and sustainable finance for Saudi Arabian British Bank (SABB), of which it owns a 40% stake, since June 2018.

### \$23mn

HBME in Egypt signed a collaborative agreement in December last year to help SMEs get access to EGP400 million (\$23mn) in leasing

and low interest financing services throughout 2019. The collaboration supports initiatives by the government and the Central Bank of Egypt (CBE) to boost the SME sector; widely regarded as the backbone of the country's economy.

### 367

Staff training for 367 HBME professionals was conducted last year. This included relationship managers, directors and department heads trained on sustainable finance in the UAE, Egypt, Oman, Kuwait, Bahrain, Qatar and Saudi Arabia.

### 7,000+

HSBC supported 158 shareholder resolutions on environmental and social issues last year and voted at more than 7,000 company meetings at a global level.

### 58

HSBC globally engaged on ESG issues with 1,219 companies, in 58 countries - nearly 30% of the countries worldwide.

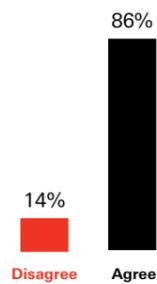
# Middle East Energy Transition Survey

Think Global & Act Local to Accelerate Impact!

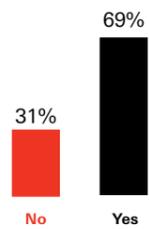
Our survey polled 600 regional stakeholders from industry, government and academia in December 2018 on what next steps are required to accelerate the region's energy transition.

“Some 86% of respondents identified that it was critical for the Middle East to develop competent and integrated local supply chains to propel their energy transformation. Some 69% said they were confident the region had the right financial vehicles in place to facilitate the needed investment towards more sustainable forms of energy.”

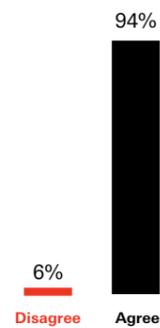
The existence of a competent and integrated local supply chain are critical for Middle East countries to be able to accelerate its energy transition.



Policies that provide secure payments to refinance renewable energy investments and help liberalize the power sector would be significantly beneficial in attracting more investments in energy transition projects. Does the Middle East have the right financial vehicles in place to facilitate the needed investment towards more sustainable forms of energy?

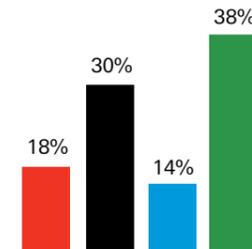


Middle East countries need to go beyond their current focus on the power sector in embracing renewable energy and energy efficiency initiatives for water desalination, industrial and transportation sectors?



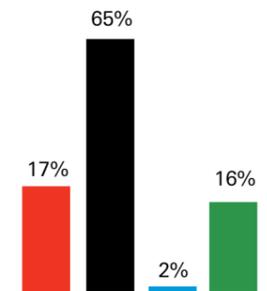
In order to make the transition toward secure, efficient, and low-carbon energy systems, which of the following should be the most important next step in the Middle East?

- A. Define the need for alternative energy sources
- B. Identify alternative (sustainable) energy options
- C. Define energy consumption per sector
- D. Define sectoral and intersectoral energy transition strategies

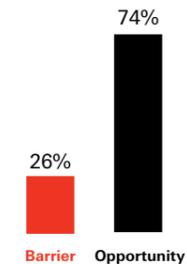


Saudi Arabia has promised to invest over \$100 billion to develop 41 gigawatts of solar electricity by 2032, while most other Middle East countries have announced similar ambitious transition projects of their own. Which Middle East country do you think is currently leading on energy Transition implementation?

- A. Oman
- B. UAE
- C. Egypt
- D. Saudi Arabia

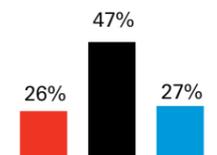


The diverse range of new energy sources within the Transition will need complete infrastructure right through the value chain – from production and capture to processing, storage and transportation – is the Middle East legacy fossil-fuel energy infrastructure an opportunity or barrier to energy transition?

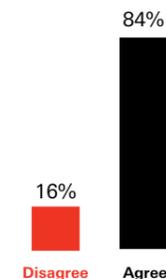


Which of the following criteria is the best one to use to measure a Middle East country's progress in implementing an Energy Transition strategy?

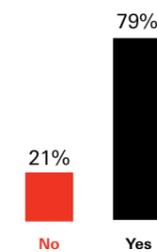
- A. Removing subsidies on fossil fuels
- B. Amount of money invested in Renewable energy projects
- C. Competence of local supply chain to deliver



The World Economic Forum declared earlier this year that the global energy transition is still not moving fast enough. And therefore the WEF said the ball is back in policymakers' court to accelerate the shift to the clean energy solutions of the future.

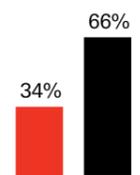


In June the EU agreed a 32% EU renewable energy target for 2030 in June and Spain became the first EU state to create a Ministry for Ecological Transition from merging the former Ministries for Environment and for Energy. Is it possible to get left behind in the great energy transition and miss out on its economic rewards now estimated at \$1 trillion per year?



There is a two-part solution for countries to overcome the energy transition challenge. Firstly, increase supply of zero-carbon energy alternatives; and secondly, reduce demand for fossil fuels. Which of these policies should Middle East countries prioritize?

- A. Reduce demand for fossil fuels
- B. Increase supply of zero carbon energy





# Keep the Green Dollars Coming



BY ZOE KNIGHT  
Group Head, Centre of Sustainable Finance, HSBC

Have no doubt: the energy transition is expensive business. Investor confidence is pivotal to meeting a target that the world cannot afford to miss: the sustainable implementation of the Paris Agreement. What is one key ingredient to buoy investors' appetite? Transparency. We are all still figuring out what 'good

decarbonization' looks like, so bolstering clarity will improve forecasts and risk-reward profiles. Meeting the goals of the energy transition and the Paris Agreement requires a greening of the global financial framework through easy communication and deep-collaboration. These often

**\$300bn**  
For the fifth consecutive year, global clean energy investment exceeded the \$300 billion benchmark, reaching \$332 billion in 2018, detailed Bloomberg New Energy Finance (BNEF).

used words can easily lose meaning. But there is no time for slack schedules; the environmental clock is ticking too loudly.

One major step that requires both is Article 14 of the Paris Agreement, which details the need to periodically take stock of implementation and to assess collective progress towards achieving its purpose and long-term goals. This process is called the global stocktake and is due in 2023. Success at navigating the myriad of nuances in every company, country and region to achieve this goal means the effectiveness and timeliness of this process in just four years will be key to setting the global tone going forward.

Greater clarity on how the Agreement is progressing will ensure that economic and environmental forecasts – for both fossil fuels and renewables – are as accurate as possible. Having such signposts will help investors move step-by-step through what is largely uncharted territory and enable them to mitigate the assumed risks, such as stranded assets and the physical implications of climate change (forced migration, natural disasters). In turn, this frees up capacity to deal with the uncertainty of how the changes will play out and the best financial instruments to help the energy industry adapt. This will help relieve an unnerving guessing game, which risks putting even budding climate-finance pioneers on the back foot.

## GREEN FUTURE

Momentum towards the energy transition is certainly growing. In the GCC alone over the last five years, renewable energy has made striking gains. Among other renewable and energy efficiency targets, clean energy must account for 44% of the UAE's energy capacity by 2050, Saudi Arabia is aiming for 30% of generation from renewables and others (mainly nuclear) by 2030 and Kuwait is aiming for 15% in the same year. Green goals form a cornerstone of countries' National Visions and all signed on the dotted line of the Paris Agreement, submitting comprehensive nationally determined contributions (NDCs). For example, Saudi Arabia's NDC included the aim of becoming a global technology leader in carbon capture and storage (CCS) – a move that can help showcase the region's innovative spirit. And the UAE already hosts close to 79% of the installed solar PV capacity in the GCC and has managed to attract some low-cost solar PV projects without offering

Achieving renewable energy deployment targets would reduce emissions by 136 million tonnes of carbon dioxide, according to IRENA.

subsidies, according to Abu Dhabi-based International Renewable Energy Agency (IRENA). This is monumental in a region where subsidies have long been intertwined with economic growth.

IRENA highlights how progress has elevated from small-scale pilot projects to almost 7GW of new power generation capacity and record-breaking bids in renewable energy auctions in the UAE and Saudi Arabia. Such auctions also made solar power cost-competitive with conventional energy technologies – an impressive step-change for the historical epicentre of fossil fuels. Geography is a major ace card in the region's clean energy game. Aside from abundant sunshine, GCC countries – particularly Kuwait, Oman, and Saudi Arabia – have good wind resources that are being affordably leveraged with the deployment of higher turbine towers and longer blades.

Achieving renewable energy deployment targets would reduce emissions by 136 million tonnes of carbon dioxide, according to IRENA. It would also create more than 220,500 direct jobs in a region that forms part of the Middle East and North Africa (MENA), which the International Labor Organization (ILO) said retains the highest rate of youth unemployment worldwide. And water withdrawal for power production and associated fuel extraction would also fall by 11.5 trillion litres (-17%); critical for a region facing water scarcity challenges.

The cost of investment in clean energy is well countered – if far exceeded – by the above benefits. The equation is simple: the world needs the energy transition, the energy transition needs investors and investors need transparency. Lift the veil and the funds will flow more easily: truly a win-win.

**-8%**

While total global green energy exceeded \$300 billion last year, it was still 8% down on 2017 – particularly surprising considering the growing momentum of emerging markets in this field. Why? In short, the magnitude of change incurred by the great energy transition takes some time to get used to.

**3%**

Wind investment rose by 3% last year to \$128.6 billion, with offshore wind having its second-highest year. Money committed to smart meter rollouts and electric vehicle company financings also increased, BNEF reported.

**-24%**

Solar commitments declined by 24% to \$130.8 billion in 2018, according to BNEF, even though newly added photovoltaic capacity meant the 100GW barrier was broken for the first time.

**12%**

The decline in solar is in part due to sharply declining capital costs and BNEF's global benchmark for the cost of installing a megawatt of photovoltaic capacity fell by 12% in 2018 as manufacturers slashed selling prices amid a glut of PV modules on the world market.

**\$21bn**

The value of sustainability and SDG bonds issued in 2018 – a staggering 114% year-on-year rise, Climate Bonds' data revealed.

**\$1.6trn**

Carbon Tracker warned that fossil fuel companies risk wasting \$1.6 trillion of expenditure by 2025 if they base their business on emissions policies already announced by governments instead of international climate goals.

# A Complementary Blend

## Fossil Fuels & Renewables in the 21<sup>st</sup> Century

BY H.E. SAIF HUMAID AL FALASI  
GCEO, ENOC Group; former Technical Advisor for Deputy CEO ADNOC;  
former Deputy General Manager, ZADCO; former Head of Reservoir  
Engineering, ADMA-OPCO



The oil and gas markets that have been the wind in the sails of the Middle East's economic growth since the mid-1900s are charting a new course. A new era beckons as rising populations and obligations to the Paris Agreement mean an 'energy basket' will be the mainstay of the 21<sup>st</sup> century. BP Outlook anticipates a 55% increase in the Middle East's energy consumption up to 2040. A multifaceted energy basket, which utilizes both fossil fuels and renewable energy, is a proactive approach to meet this demand at an affordable cost.

The UAE Energy Strategy 2050 illustrates how the future energy mix will have a low-carbon theme: the country's 'basket' will comprise 38% gas, 44% clean energy, 6% nuclear, and 12% clean coal. Efforts to increase low-carbon and renewable energy growth are wide-ranging, with significant changes already under way. The UAE government aims to invest AED 600 billion (\$163 billion) by 2050 to meet the growing energy demand and ensure a sustainable growth for the country's economy, while strategies to mitigate the negative impacts of climate change and build a green economy are two threads of the 'Sustainability' theme at EXPO 2020 in Dubai. The UAE's Barakah nuclear power project is another example of the UAE's pioneering dedication to a low-carbon future – it will be the Middle East's first nuclear power plant when it starts coming online later this year. But leveraging renewable energy does not translate into fossil fuels being a 'sunset industry', ready to fade into history books. Oil and gas will remain an integral part of the global energy mix for at least four more decades.

“The UAE Energy Strategy 2050 illustrates how the future energy mix will have a low-carbon theme: the country's 'basket' will comprise 38% gas, 44% clean energy, 6% nuclear, and 12% clean coal.”

“It is far too early to write the obituary of oil, as growth for trucks, petrochemicals, shipping and aviation keep pushing demand higher,” said Dr Fatih Birol, the International Energy Agency's (IEA's) Executive Director. The agency's World Energy Outlook 2017 report details how oil demand will continue to grow up to 2040, although at a steadily decreasing pace. But other sectors – namely petrochemicals, trucks, aviation and shipping – drive up oil demand to 105 million barrels a day (b/d) by 2040.

### FRIENDS, NOT FOES

Renewables will play a complementary, rather than competitive, role to fossil fuels in the foreseeable future. But there is no doubt that energy and economic security in Dubai and beyond relies on the prosperity of both. BP Energy Outlook anticipates that the Middle East will remain the world's largest oil producer and the second-largest gas producer. The region will account for over 34% of global liquids production and 20% of gas production by 2040. At the same time, the share of non-fossil fuels in the Middle East's primary energy demand mix increases from 1% in 2017 to 13% in 2040. While non-fossil fuels account for a smaller percentage in 2040, the figures still mark a steady growth rate when considering it will require new

technologies, policies and a societal shift in the way energy is consumed. It would be a mistake to discount the importance of renewables.

Gulf countries' innovative plans to merge both camps – fossil fuels and renewables – are already paying off in the field of enhanced oil recovery (EOR) technologies. Projects centered on a win-win scenario are helping reduce emissions and streamline operational costs. The latter is especially pertinent amid today's oil prices. One illustration of how the two camps blend their operations lies to the east. Once fully operational, Oman's Miraah solar thermal plant will generate 6,000 tons of steam per day via 36 glasshouses to support state-owned and Shell-led Petroleum Development Oman's (PDO) existing thermal EOR technology at the Amal field. The \$600 million project came online in the last quarter of 2017 and has the potential to make an 80% saving of natural gas at the field.

Nurturing talent to drive this new blend of energy innovation in the 21st century will climb higher on energy companies' agendas. Critical and imaginative thinkers with fluency in the digital tools of the 4th Industrial Revolution will be integral to carving out the new status quo. Mastering the rapidly growing digital tool box – from predictive analytics, big data



## Green targets

The UAE formally ratified the Paris Agreement in September 2016. The Agreement is the world's most comprehensive deal to mitigate the negative impacts of climate change and marks the biggest rise in political momentum for positive change since the Kyoto Protocol was signed in 1997. Efforts to pin down the finer details of each country's commitments are discussed throughout the year and at the United Nations Framework Convention on Climate Change, held annually in the fourth quarter. Looking ahead, energy companies will have to frequently review their roadmaps to accommodate the increasingly strict rule book.

### 2°C

Improved energy efficiency will play a vital role in meeting the Paris Agreement's long-term goal of keeping the increase in the global average temperature to well below 2°C above pre-industrial levels.

### 2016

Progress is under way. The Netherlands' Environmental Assessment Agency said the level of CO2 emissions in the world's biggest emitting nations either fell or were static in 2016, in large part due to energy efficiency.

### 28%

The global population will rise to 9.7 billion from today's 7.6 billion – a 28% climb. Affordably meeting energy demand while hitting low-carbon targets could become harder, not easier. Proactive efforts are vital.

### 2,100

A Waste Heat Recovery project at the ENOC Refinery saved natural gas consumption equivalent to AED2.7 million a year. Flue gas temperatures were reduced from 250°C to 150°C, ensuring more efficient energy usage over the lifetime of the naphtha hydrotreatment plant. It also includes an annual reduction of CO2 emissions by 10,000 tons, equating to removing 2,100 cars from the roads for one year.

“Collaboration, transparency and innovation will enable energy companies to surf the waves of positive change, rather than being submerged by them.”



to artificial intelligence – will be vital to energy companies' ability to meet rising demand, while streamlining costs and reducing emissions. Efforts to continually enhance human capital also encompass bolstering the rate of nationalization and supporting entrepreneurs, as well as small and medium-sized enterprises (SMEs). MENA Research Partners (MRP) forecasts that the number of SMEs in the Gulf Cooperation Council (GCC) will rise by 156% in the next five years, with the sector worth \$920 billion. What strategies will most effectively channel this vast potential of financial and

human capital – a core part of Dubai's growing workforce – towards affordably ensuring energy security?

The answer is collaboration, transparency and innovation, which will enable energy companies to surf the waves of positive change, rather than being submerged by them. A proactive approach is crucial. As best said by His Highness Sheikh Mohammed Bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai: “Opportunities are made. They do not just lie around waiting for someone to grab them.”

**WATER SCARCITY:**  
*Reversing the Narrative*

Water scarcity has been highlighted by the World Economic Forum (WEF) as one of the greatest global risks to economies, environment and people. Strategies to reuse and recycle water used during operations will increasingly become a priority for energy companies.

## Efficiency ethos must gain pace

Energy efficiency represents a key release valve on the burgeoning pressure to meet rising demand. Energy intensity – measured as the amount of primary energy demand needed to produce one unit of gross domestic product (GDP) – fell by 1.7% in 2017, the slowest rate of improvement this decade. Why? Global energy demand rose by 1.9% in 2017 – the fastest annual increase since 2010. This meant that the forces driving up energy demand, led by strong economic growth, outpaced progress on energy efficiency.

### 2040

By leveraging the range of cost effective energy efficiency opportunities widely available today, energy intensity would improve by around 3% per year between now and 2040.

### \$500bn

Efficiency gains alone could allow the world to extract twice as much economic value from the energy it uses compared to today. Doing so would reduce energy bills for consumers by more than \$500 billion per year and lower pollution levels.

### 4.5x

The economic efficiency of renewables improved in 2017, spurring investors' appetite. In emerging markets, the average size of awarded solar PV projects in auctions rose by 4.5 times while that of onshore wind rose by half between 2013-2017.

### 3%

In the past, there has been a roughly linear relationship between upstream costs and oil prices. When prices spiked, so did costs, and vice versa. What the IEA now notes is a decoupling. While oil prices have more than doubled since 2016, global upstream costs have remained substantially flat. Companies appear to have learned to do more with less.

Sources: International Energy Agency (IEA); World Energy Investment 2018 Report and Efficiency Report 2018  
<https://www.iea.org/wei2018/>  
<https://www.iea.org/newsroom/news/2018/october/energy-efficiency-is-the-answer-for-building-a-secure-and-sustainable-energy-syst.html>

### 12.7bn

The planet's oil wells will produce 12.7 billion gallons a day of water by 2020, according to Total. This equates to an average of three to five barrels of water for every barrel of oil produced.

### 14%

MENA will have the greatest expected economic losses from climate-related water scarcity by 2050, at up to 14% of GDP.

### 60

A member of the ENOC Group, the Dugas Waste Water Treatment project has purified waste water so that it can be used for irrigation. Water saving of more than 26 million liters per year is equivalent to reducing water demand for 60 households in Dubai.

# There are No More Detours

## The Energy Transition is Here to Stay



BY RAOUL RESTUCCI

Managing Director, Petroleum Development Oman; former head of Economics and Planning, Qatar Petroleum; former Executive Vice President for Middle East, Russia and CIS, of Shell E&P Middle East

Fossil fuels are not going away – they will remain an integral part of the energy mix for many decades to come. OPEC’s World Oil Outlook 2018 forecasts that oil demand will have the largest share of the energy mix through to 2041, increasing by 14.5 million barrels a day (b/d) to reach 111.7 million b/d by 2040, although the growth will decelerate over time. But rising energy needs, shifting supply such as the expansion of US shale oil, climate change pressures and technological innovation mean national oil companies (NOCs) must gravitate towards renewables for longer-term competitiveness and sustainability.

Middle East countries with their high levels of solar density and increasing deployment are well-placed to build momentum and drive change – Oman is a prime example. The economic impact of the oil price volatility since 2014 has given more impetus to the need to diversify energy portfolios, while continuing to meet customer expectations with rising domestic and global demand. At the same time, there is the need to achieve greater efficiencies through new leaner and digital ways of working and technologies.

The advent of the 4th Industrial Revolution – defined by emerging technologies like automation, machine learning, artificial intelligence and data analytics – offers NOCs and other industry stakeholders many opportunities to operate as safer, more productive and environmentally responsible businesses.

At the same time, gas and its more pervasive deployment, is an enabler to the energy transition. The introduction of gas-

“The advent of the 4th Industrial Revolution – defined by emerging technologies such as automation, machine learning, artificial intelligence and data analytics – offers NOCs and other industry stakeholders many opportunities to operate as safer, more productive and environmentally responsible businesses.”

solar swaps, for example, could generate the further investment countries like Oman need to fully mature themselves as hubs of renewable energy development and know-how.

With an investment of \$200 billion in green energy infrastructure, and the 200,000 jobs it is forecast to create in the Middle East over the next five years, PDO needs to build on the pioneering work we have already commenced across a full supply chain of opportunities.

Currently, the Omani Government’s Tanfeedh program on enhancing economic diversification is targeting in excess of

10% of the country’s total energy to be generated by wind and solar by 2025. PDO is already playing its part in supporting this aim by integrating solar into both our oil and non-oil portfolios and investigating where we can leverage new technology and expertise to commercialize our services in areas, such as project management, engineering and design, in order to develop into a fully-fledged energy company.

Our flagship Miraah solar energy project, being developed with GlassPoint, is providing a highly reliable and sustainable development solution to our increasing energy needs. The project shows that producing steam with solar is now competitive as we redeploy and monetize the saved gas for use in higher value domestic and export options.

We are also installing 11 megawatts (MW) of solar photovoltaic panels in our Muscat headquarters to provide power for offices, with surplus electricity being fed into the wider grid. We have just awarded a contract for a 100 MW independent power producer project in our fields to a Japanese-Omani consortium, which is scheduled for May 2020.

Projects like these represent a good start, but there must be greater alignment and collaboration between Oman’s public and private sectors to evolve towards a greener future. This is across all aspects, including strategy, research and development, technology, training, supply chain development and investment. I remain confident and excited about staying competitive and playing our part in meeting the challenges of the future.

### 2040

Oil demand of 111.7m b/d is anticipated by 2040, according to OPEC’s World Oil Outlook 2018 – an increase of 14.5m b/d from today. Oil demand will have the largest share of the energy mix through to 2040.

### \$200bn

PDO’s investments into green energy infrastructure over the next five years, which is also forecast to create 200,000 jobs in the Middle East.

### 11 MW

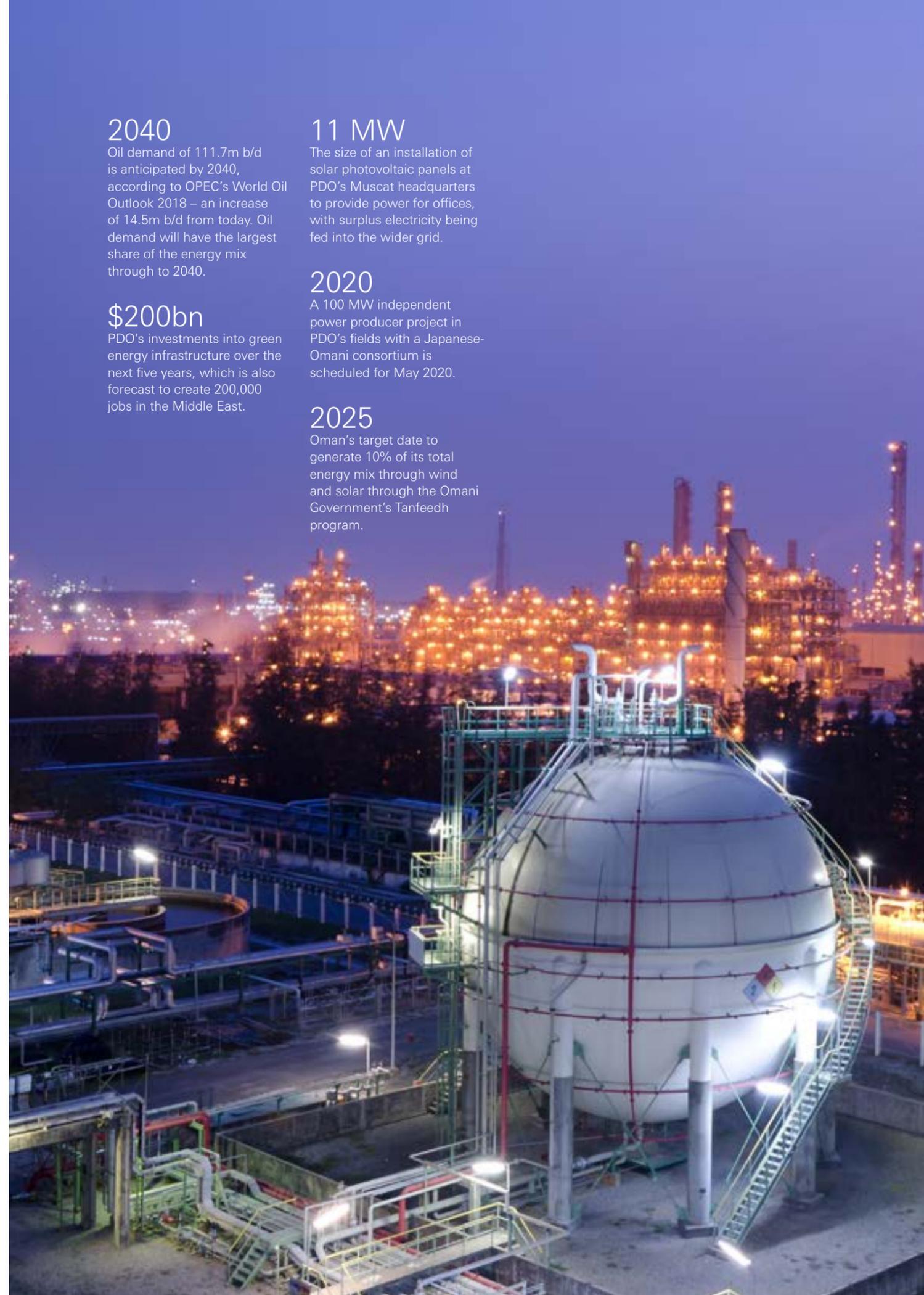
The size of an installation of solar photovoltaic panels at PDO’s Muscat headquarters to provide power for offices, with surplus electricity being fed into the wider grid.

### 2020

A 100 MW independent power producer project in PDO’s fields with a Japanese-Omani consortium is scheduled for May 2020.

### 2025

Oman’s target date to generate 10% of its total energy mix through wind and solar through the Omani Government’s Tanfeedh program.





# NOCs are Learning the Ropes – Quickly.

BY ABD MALIK JAFFAR  
Regional Director, PETRONAS Subsidiaries Middle East, PETRONAS;  
Head Iraq, PETRONAS Carigali Iraq Holding; former Head of Projects  
and Engineering, PETRONAS



Gone are the historical criticisms that national oil companies (NOCs) are reactive, not proactive. A new forte to flex has given them a firm lead in the global journey towards a diversified energy portfolio. Frequent edits to Middle Eastern NOCs' mission statements over the last five years have resulted in a unique achievement: the world's biggest oil producing region is also a pioneer in renewable energy.

In the UAE alone, the Vision 2021 and National Agenda expects the OPEC member to generate 27% of its energy requirements from clean energy sources,

reduce its per capita greenhouse gas emissions and achieve average oil consumption of five tons per person in just 2.5 years. The country's Mohammed bin Rashid Al Maktoum Solar Park will be the largest single-site solar park in the world that uses the independent power producer (IPP) model, producing 1,000 MW by 2020 and 5,000 MW by 2030. The AED50 billion (\$13.6 billion) project will achieve a reduction of approximately 6.5 million tons of carbon emissions annually.

Both goals are just the tip of the iceberg, with NOCs implementing lower-carbon initiatives across their value

**27%**  
The amount of energy that the UAE Vision 2021 and National Agenda expect the country to generate from clean energy sources, reducing per capita greenhouse gas emissions and achieving average oil consumption of five tons per person.

**\$13.6bn**  
The value of Dubai's Mohammed bin Rashid Al Maktoum Solar Park; the largest single-site solar park in the world that uses the independent power producer (IPP) model. The project is expected to produce 1,000 MW by 2020 and 5,000 MW by 2030 and reduce 6.5 million tons of carbon emissions annually.



chains in the UAE and the wider Middle East. Abu Dhabi National Oil Company (ADNOC) reduced its zero-flaring by 78% between 1995 and 2010 and Dubai-based ENOC launched the first solar-powered service station in the UAE last year, with more to come. Politically-backed with relatively deep-pockets, NOCs have the capability to build a bridge uniting the established and emerging; blending fossil fuels and renewables into one mix.

NOCs' appetite for stepping outside their comfort zones has become increasingly common, reaffirming confidence that they will be integral leaders in this new chapter. Take the birth of 'international NOCs' over the last two decades, for example. They have leveraged their cross-border influence to become progressively influential in a territory typically dominated by international oil companies (IOCs). Chinese companies CNOOC and CNPC – with approximately one-third of foreign production – have implemented overseas strategies since the early 1990s, mainly in Asia and Africa, while Petrobras expanded internationally after the Brazilian oil-sector deregulation in 1997. In Asia, Malaysian Petronas' internationalization started in 1991 with upstream investments in Vietnam and the company is now present in more than 20 countries – approximately 10% of the world's nations. Similar patterns are noted in most major NOCs, including those in the Middle East.

With 85-90% of global proven resources and around 70% of total production, NOCs' expansion has affected the entire industry and resulted in a highly concentrated resource base. The top five NOCs worldwide account

for more than half of global oil-proven reserves. Such reserves are mostly located in OPEC member countries (72%), with Venezuela and Saudi Arabia at the top of the list.

But as the global energy mix evolves to have fossil fuels and renewables as two sides of the same commercial coin, so must skill sets at NOCs. Seven core strategies will help sharpen their game. First up is agility, giving organizations better chances to survive in a fast-changing ecosystem. Second is early positioning in segments that are gradually displacing current products and services, such as the rise of renewables and shifting consumption habits. Also on the list are customer-centric business models, digitalization, fast adoption of new technologies, horizontal collaboration and the dynamic management of highly diversified portfolios. Embracing these core principles will create a stronger and more diverse energy market, which is vital to coping with intensifying demand. The International Energy Agency (IEA) said in March 2018 that the global appetite for energy in 2017 rose by 2.1% – more than twice the previous year's rate.

NOCs are gatekeepers to arguably the most precious asset a country has; energy security. Without reliable access to energy, much starts to fail. The great energy transition has thrown up many question marks that demand answers with clear parameters; how to manage R&D for innovative technologies and policies, bolstering talent creation and how best to divide investments into the two 'camps' of fossil fuel and renewables, for example. NOCs must use their influence as a beacon for those mired in ambiguity to find their way.

“The top five NOCs worldwide account for more than half of global oil-proven reserves.”

**78%**  
The reduction in ADNOC's zero-flaring between 1995 and 2010.

**70%**  
Globally, NOCs have 85-90% of global proven resources and around 70% of total production.

**2.1%**  
The rise in the global appetite for energy last year – more than twice the previous year's rate.

**10%**  
Petronas' internationalization started in 1991 with upstream investments in Vietnam. The company is now present in more than 20 countries – approximately 10% of the world's nations.



# Saudi Arabia

## The Kingdom's Energy Transition Finally Starting to Shape Up

BY BRUNO BRUNETTI

Managing Director, Head of Global Power Strategy, Analytics, S&P Global Platts; former Managing Director, Global Power, PIRA Energy Group; former Research Associate at Caminus and CERA (IHS Markit)



Saudi Arabia's quest to diversify its power generation mix away from traditional sources – most notably crude – is now more clearly shaping up. Significant power demand growth (and historically low domestic energy prices) has made this task quite challenging. But efficiency gains in power usage will be emerging in a less subsidized energy price environment.

A high penetration of electricity in the residential and commercial sector (the residential sector alone accounts for more than 48% of the total, with another 30% from commercial and government sectors) led to steep growth for total power demand over the past decade (5.8% per annum). Peak demand also grew by almost 7% on average over the same time period,

according to data from the electricity regulator Electricity & Cogeneration Regulatory Authority (ECRA).

Peak demand has already reached 62.26 gigawatts (GW), against an average power dispatch on the order of 34 GW. This requires large spare capacities to meet the peak and average utilization of capacities is fairly low. As a form of comparison, peak demand in Europe is only 40% higher than average demand. Poor utilization of thermal assets has become a challenge for utilities in Europe as well (or even in the US). But unlike Saudi Arabia, power demand in those countries has already stabilized, or is even shrinking.

Saudi Arabia's government reform of energy prices started in 2015 and

the changes in behavior were nearly immediate. Electricity demand growth slowed to 0.7% year-on-year in 2016 (down from 4.8% growth in 2015), with peak demand down by 2.3% year-on-year – the first decline in more than 20 years.

More specifically, residential demand shrunk by 0.8 terawatt hours (TWh), or by 0.6%, while the number of total customers increased by 6%. Although Saudi Arabia will aim at further attracting energy intensive industries as part of its reforming agenda, more efficient uses in the residential sector could limit the demand growth, especially at peak hours.

Beyond demand, the capacity mix is now clearly evolving toward more efficient units, with S&P Global World Power Plant

“Although Saudi Arabia will aim at further attracting energy intensive industries, more efficient uses in the residential sector could limit the demand growth, especially at peak hours.”

Database showing the commissioning of a number of large units in sight. Almost 20 GW of new plants are set to come online within the next 2-3 years, or nearly a quarter of the country's installed capacity.

A notable development in the generation mix is that with the new projects coming online, the role of high sulfur fuel oil (HSFO) and gas are set to get stronger in the generation mix at the expense of crude. The increased ability to burn HSFO is occurring at a critical time in the oil industry. The International Maritime Organization's (IMO) 0.5% cap on sulfur in shipping fuel comes into effect on the 1 January 2020. S&P Global Platts Analytics' study, Making Waves, shows there is insufficient desulfurization capacity worldwide to fully transform the volumes of HSFO produced by the world's refineries into low-sulfur fuel. Saudi Arabia's strategy to move away from crude in the power sector could not have happened at a better time, as the world will have an increasing surplus of HSFO. We expect Saudi Arabia's HSFO burn in the power sector to increase by roughly 200 million barrels a day (b/d) through 2020 as a result of the new facilities installed, with

additional switching potential away from crude estimated at 100-200 million b/s in 2020 due to the upcoming IMO regulations.

The recent commissioning of the 1.2 GW CCGT Waad Al-Shamal plant also marks an important step in Saudi Arabia's wider energy strategy. This plant offers an interesting example of integration of CSP (Concentrated Solar Power) with a thermal plant, as a CSP unit complements the gas turbine that generates electricity. Similarly, the 500 megawatt (MW) Duba Green Power plant in Saudi Arabia is another example of an Integrated Solar Combined Cycle (ISCC) in the Western region. During the daylight hours, solar complements gas, with the co-location of the two technologies offering benefits and costs reduction in the form of simultaneously reducing fossil fuel usage and integration costs of solar power. As the Kingdom starts ramping up its renewable deployment program, the bids for the first utility-scale projects (the 300 MW Skaka PV plant and the 400 MW Dumat Al Jandal wind) have surprised for their low-price levels, confirming the Kingdom's vast potential in renewables.

**5.8%**  
Saudi Arabia's power demand has grown by 5.8% per annum over the past decade, according to the Electricity & Cogeneration Regulatory Authority (ECRA).

**2020**  
The increased ability to burn high sulfur fuel oil (HSFO) is occurring just in time; the International Maritime Organization's (IMO) 0.5% cap on sulfur on bunker fuel, down from 3.5%, comes into effect on the 1 January 2020.

# Falling Cost of Solar Harnessing Opportunities

BY ADNAN Z AMIN

Director-General Emeritus; Former First Director-General of the International Renewable Energy Agency (IRENA); former Head of the UN System Chief Executives Board for Coordination (CEB); former Director of the United Nations Environment Programme's (UNEP) New York Office; former Special Representative of the UNEP Executive Director; former Trustee and Member of the Board of Directors of the Cambridge, UK-based World Conservation Monitoring Centre



The global energy system is witnessing rapid and disruptive change. This transformation driven by renewables is fundamentally reshaping the way we generate, consume and distribute energy. It is also transitioning us to a low-carbon energy system, which brings new economic opportunities. Solar energy is at the heart of this transformation, and falling costs are underpinning its remarkable growth.

Solar photovoltaic (PV) module prices have declined by more than 81% since 2009 and the average cost of power from utility-scale PV modules has fallen by 73% since 2010, bringing it firmly within the fossil fuel power generation cost range. Furthermore, solar PV costs are expected to halve again by 2020, bringing average costs significantly below traditional energy.

This has fueled unparalleled expansion in solar PV capacity from less than one gigawatt (GW) in 2000 to almost 300 GW worldwide in 2017. Last year, installed capacity grew by 32%; China alone added 54 GW of solar PV. Beyond PV, concentrated solar power (CSP) holds tremendous promise and its costs are witnessing similar declines. Our analysis shows CSP projects commissioned between 2020 and 2022 will have dropped within the fossil fuel power generation cost range.

These cost reductions present an opportunity to accelerate solar energy deployment in the pursuit of numerous objectives, from economic development and diversification to enhancing energy security and addressing climate change. In

few regions is this opportunity greater than in the Middle East. With some of the lowest prices for solar achieved through auctions in the region, countries are seizing it.

The UAE has been at the forefront of these developments. In Abu Dhabi, a 350-megawatt (MW) solar PV auction in 2016 resulted in a record low price of USD2.4 cents per kilowatt-hour (kWh), while in 2017 Dubai awarded a bid to build a 700 MW CSP plant which will generate electricity with storage for USD7 cents per kWh. Once complete, the Dubai plant will be the world's largest. These projects will help the UAE achieve its energy strategy to cut carbon dioxide emissions by 70% and generate 44% of its power from renewable energy by 2050.

In 2017, Saudi Arabia unveiled ambitious plans to scale up renewables as part of its economic diversification strategy under its Vision 2030, setting a 9.5 GW of renewable energy capacity target by 2030. Also in late 2017, the Kingdom received record low bids for its first utility scale solar project.

Morocco is close to the completion of the second phase of the Noor Solar Complex in Ouarzazate, which will result in a total generation capacity of 510 MW of CSP, offering up to seven hours of storage, in addition to 70 MW of solar PV. A third phase is scheduled to add further generation capacity. The project supports Morocco's ambition to generate more than half of its electricity from renewables by 2030, thus reducing its reliance on expensive and volatile fossil fuel imports.

Similarly, in Egypt, the Benban Solar Park, currently under construction near the city

of Aswan, will soon be the biggest solar installation in the world, housing 32 power plants. By mid-2019, once fully operational, the plants will have a combined electricity capacity of 1,650 MW. These examples are representative of the region's desire to seize the opportunities presented by solar energy. As renewables continue to reshape both Middle Eastern economies and energy systems, further cost declines foreseen in solar power will only serve to accelerate energy transformation in this region and around the world.

**81%**

The drop in solar photovoltaic (PV) module prices since 2009. Solar PV costs are expected to halve again by 2020, bringing average costs significantly below traditional energy.

**700 MW**

A concentrated solar plant in Dubai, which will be the world's largest on completion. Such projects will help the UAE achieve its energy strategy to cut carbon dioxide emissions by 70% and generate 44% of its power from renewable energy by 2050.

**1,650 MW**

The combined electricity capacity of the 32 power plants that will comprise the Benban Solar Park in Egypt.





## The Paris Agreement: Why the Middle East is a Key Stakeholder

BY MARIA VAN DER HOEVEN

Senior Fellow at Clingendael International Energy Programme (CIEP); Former Executive Director, International Energy Agency (IEA); Former Minister of Education, Culture and Science, Netherlands; Former Minister of Economic Affairs and Energy, Netherlands



Every Middle Eastern country has now signed the Paris Agreement, a cooperation within the United Nations Framework Convention on Climate Change (UNFCCC). The Agreement starts in 2020 and tackles issues such as dealing with greenhouse gas emissions mitigation, adaptation and finance. In recent years, countries have submitted their clean energy plans known as National Determined Contributions (NDCs).

Energy consumption patterns in the various Arab countries are about to change, as consumption needs to gradually become more environmentally-friendly. This is not only driven by the policy choices formulated in the NDCs of countries in the region, but also by

the technological change that will result from shifting energy policy preferences worldwide. The Paris Agreement has given renewed impetus to the development and adoption of clean energy production, conversion, transport and storage technologies. This is relevant to the Middle East, for at least two reasons. When energy importing regions move away from the combustion of carbon-intensive fossil fuels, this could affect global fossil fuel demand and could negatively impact trade balances of exporting countries. At the same time, such a shift can create opportunities in the Middle East with respect to exporting clean energy carriers in efficient, innovative and perhaps unforeseen ways. The development of

hydrogen, among others, as a clean energy carrier may prove vital here.

Energy use today generally results in unabated CO<sub>2</sub> emissions. Energy efficiency improvements are therefore widely regarded as essential measures to contain the carbon intensity of energy economies. For MENA, the World Bank estimates the potential for savings from energy efficiency at 21% of projected total primary energy supply by 2025.

Due to an abundance of energy resources in the region, energy efficiency has historically not been the policy priority that it has been in some of the world's energy importing regions, such as Europe and Japan. Also, at a share of 30%, oil combustion for power

“The Middle East is well positioned to play a relevant role here on the global stage. But regional cooperation is essential in order to integrate all the options in new value chains, strengthen the knowledge base, develop and scale-up technologies and ultimately satisfy shifting consumers preferences.”

generation is high in the region, while it is often regarded as uneconomic and environmentally unattractive elsewhere. Ongoing research on the relevance of ‘relative prices’ of different energy carriers in the economy for the energy mix and how such prices come about suggests that this can be addressed.

Energy efficiency is not a goal in itself. Rather, ‘carbon efficiency’ could also prove to be a useful metric, particularly for countries that possess abundant fossil energy resources. If domestic energy resources are harvested while the negative impacts are reduced, such resources can continue to underpin the regional economy and wellbeing of people in coming years and facilitate further modernization. For carbon efficiency to improve sufficiently over time however, it is essential to close carbon cycles. For instance, through the adoption of carbon capture, utilization and sequestration (CCUS) approaches.

Additionally, hydrogen as an emerging energy carrier, could prove to be vital. The renewable energy producing potential in the Middle East is enormous. Impressive renewable energy projects are realized at

ever lower cost levels, contributing to an affordable and clean electricity supply in the region itself.

But for clean energy exports to materialize, production must be connected to distant markets and long-distance electricity transport remains challenging. Fortunately, while transport of hydrocarbons and CO<sub>2</sub> overseas is well-known territory across the globe, pilot projects for shipping hydrogen over long distances are in the making. Further development and adoption of renewable hydrogen technologies may turn out to be an essential enabler for future clean energy exports from the region.

This is where renewable energy production, innovative hydrogen and carbon chemistry and the closing of carbon cycles could come together. The Middle East is well positioned to play a relevant role here on the global stage, but regional cooperation is essential in order to integrate all the options in new value chains, to strengthen the knowledge base, develop and scale-up technologies and ultimately satisfy shifting consumers preferences in traditional and new markets.

1<sup>st</sup>

The Paris Agreement is the world's most comprehensive and truly integrated agreement to mitigate the negative impact of climate change. The ambitious agreement established in the French capital in December 2015 marked a major step on from the Kyoto Protocol, signed in the Japanese city of the same name in 1997.

184

So far, 184 of the 197 Parties to the Convention supporting the Paris Agreement have ratified their commitments.

21%

The World Bank estimates that the potential efficiency savings of projected total primary energy supply for the Middle East and North Africa by 2025 could reach 21%.

# Clean Hydrogen

## Next Step for the Middle East?

BY NOBUO TANAKA

President, The Sasakawa Peace Foundation; Former Executive Director of the International Energy Agency (IEA)



The International Energy Agency (IEA) does not expect peak oil demand to happen by 2040. While electric vehicles (EV) and more efficient passenger cars will reduce oil consumption for light duty vehicles (LDV), the increased oil requirement of aviation, ships and trucks will be greater than the LDV reduction. Oil use in petrochemical products will also increase. This is good news for the Middle East, but there is also some bad news.

The IEA has always underestimated the increase of renewable energy (RE) sources, so a zero-carbon society may come much earlier than expected. There are now 140 global corporations that have signed up as RE100 companies targeting 100% renewables dependency. This group is expanding; Apple, Microsoft, Facebook, Google, General Motors, BMW, Nike and Walmart are involved, to name just a few. It follows that these global leaders will insist that firms within their supply chain do the same. Likewise, many investors are now focusing on the environmental, social and

“The time has come for the Middle East to consider clean innovation by hydrogen.”

“The IEA has always underestimated the increase of renewable energy sources, so a zero-carbon society may come much earlier than expected.”

governance aspects of the companies they put their money into.

The European Union (EU) is the first institution that officially introduced the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD). Many European corporations are divesting coal-related activities. The IEA Sustainable Development Scenario said that if governments are ambitious enough to achieve net zero emissions by 2060, a peak demand of coal happens right away and it must happen by the early 2020s for oil. Natural gas will continue to be used to replace coal, but once coal is gone, gas will need to ‘de-carbon’ itself. The way forward to avoid fossil fuels becoming stranded assets is carbon capture and storage (CCS) through enhanced oil recovery (EOR) and hydrogen technologies.

Chiyoda Corporation is a leading engineering company in Japan which is developing ‘SPERA Hydrogen’ – a business model for storing and transporting hydrogen by utilizing the organic chemical hydride method. The

SPERA Hydrogen process is as follows. Methylcyclohexane (MCH), which is produced from toluene and hydrogen, can be safely and economically stored and transported by conventional oil tanks and oil tankers. Both toluene and MCH are maintained in a liquid state at ambient temperatures and pressures. If hydrogen is produced through CCS – as with EOR – it is carbon-free. Clean hydrogen is added to toluene to make MCH, which can then be transported by a regular tanker to the exporting country. When the MCH reaches its destination, it can be de-hydrogenated with a special catalyst and the clean hydrogen used for hydrogen fuel cell vehicles or power generation. Toluene can then be transported back to the Middle East. There are different technologies for hydrogen storage and transportation, such as liquified hydrogen or liquid ammonia. Solar photovoltaics (PV), which are abundant in the Middle East, can also produce clean hydrogen through electrolysis. The time has come for the Middle East to consider clean innovation by hydrogen.

140

The number of global corporations that have signed up as RE100 companies targeting 100% renewables dependency. Momentum is building; Apple, Microsoft, Facebook, Google, General Motors, BMW, Nike and Walmart are just a few of the major companies involved.

\$2trn

Yearly investment needed in new energy supply which will grow by more than 25% up to 2040, said the IEA.

\$163bn

The cost of planned the UAE’s investment into renewables. By 2050, the country hopes to have 44% of energy needs provided by renewables, 38% by gas, 12% from cleaner fossil fuels and 6% from nuclear energy.

## Technology & the Transition of Energy: What's Next?

BY LORD ADAIR TURNER

Chair of Energy Transition Commission; member of the House of Lords; Senior Fellow at the Centre for Financial Studies; former Chair Financial Services Security, UK; former Chair UK Climate Change Committee; former Director General of the Confederation of British Industry; former Vice-Chairman of Merrill Lynch Europe; and author of several books in the field of Economics and Finance



The impact of new technology on energy is going to be bigger than what most people currently realize. Over the next 10 to 15 years, we are heading towards a low-cost energy world both for fossil fuels and for renewables, with the two linked together. Renewables will start to compete with oil in electric vehicle (EV) markets. Simultaneously, the power of technology is bringing down the production cost of fossil fuels. Accordingly, the attitude of pension funds and other institutional investors in fossil fuel companies is changing.

We are going to see investors tightening their focus on the strategies that oil and gas companies are pursuing, with a lot of

pressure on those still invested in thermal coal to get out. Fossil fuel companies will be scrutinized on how robust their strategies are, not just for the cycle over the next year or two, but for the longer term. For example, we already see companies like Total and Shell making strong statements about how the balance of their business between fossil fuels and renewables will shift over time. Thermal coal use is incompatible with the Paris Agreement commitments; the developed world must get out of burning coal in power stations as quickly as possible.

The Energy Transition Commission (ETC) is currently working with the Indian





Government on how rapidly they can move beyond coal. We believe that beyond the 40 gigawatts (GW) of coal power stations already under construction there, there will probably be no more coal fired power stations built thereafter.

As chair of the UK's Climate Change Committee, in charge of our de-carbonization program in the UK, if you'd asked me back in 2008 how we should take the carbon out of electricity production, I would have said we need to use a combination of three technologies. Those are: renewables, fossil fuels with carbon capture and storage (CCS), and some nuclear. But the facts have changed. Since 2008, the cost of solar has dropped by 90%, lithium ion batteries by 80% and onshore wind by 75%. I did not anticipate those changes, but they create a new reality to which many people have not yet woken up.

The short-term impact of these changes

“Fossil fuel companies will be scrutinized on how robust their strategies are, not just for the cycle over the next year or two, but for the longer term.”

on the oil price may be negligible, but by 2030 they will be very significant. In particular, EVs are going to happen far faster than people realize. With the declining price of lithium ion batteries, it might be cheaper to buy an EV by 2025 than an internal combustion engine, as well as being much cheaper to run it. Oil will retain its other uses such as for petrochemicals and heavy transport, like

trucking and aviation. But the impact of the new technologies will gather pace over time.

Solar is a huge natural resource in the Middle East. In countries like Saudi Arabia and others, such as Mexico and Chile, we have seen solar power winning auctions at below 2 cents per kilowatt hour (kWh). Coal just can't compete with that, even before you take into account its environmental impact. And where the sun doesn't shine, we can still build power systems based primarily on renewables with short-term flexibility provided by batteries, and gas turbines providing seasonal backup but running sufficiently few hours that the average carbon intensity of electricity is still very low. ETC analysis shows that it will be feasible within 15 years, and far earlier in some favored regions, to build power systems based almost entirely on renewables at total cost well below coal-based systems. As renewable electricity

prices collapse, there is also huge potential for green hydrogen, produced by electrolysis, to play a major role in the decarbonization of fertilizer and steel production, long distance trucking and shipping.

In the short-term, oil prices look to be supported at \$60/bl or maybe slightly above due to the balance of current supply and demand and the reasonable effectiveness of current OPEC and non-OPEC producers' supply cuts. But given the sheer capacity of US shale producers and their decreasing production costs – many of which are below \$50/bl – the moment oil goes above \$70/bl, you are going to see more supply coming on stream and prices coming back down.

The other main factor to impact oil prices short-term is of course what happens in China and with Chinese demand. The buoyancy of the Chinese economy in the last two years has

surprised the World Bank, the International Monetary Fund (IMF) and all the major forecasters. Before 2016, rapid Chinese growth was underpinned by rising bank and non-bank credit provision, but with the inevitable consequence that leverage was rising to potentially unsustainable levels. Since 2016, policy has switched to provide financial stimulus with the fiscal deficit as a percentage GDP rising from close to 0% in 2014 to almost 4% today.

That has given an enormous stimulus to the global economy and is a key reason why oil and other commodity prices recovered in 2017. The key question now is whether the Chinese authorities can put in place the policies to support continued strong growth, at say 6% per annum, over the next 10 years. My judgment is that they probably can, but there could certainly be bumps along the road. Plus, any significant slowdown of Chinese growth, even if only temporary, will lead to lower oil prices.

40 GW

The volume of coal power stations already under construction in India; likely the last run.

90%

The drop in the cost of solar since 2008. Lithium ion battery costs have fallen by 80% and onshore wind by 75%.

2025

The year it might be cheaper to buy an electric vehicle than an internal combustion engine, as well as being much cheaper to run it.

# Electrifying the 21<sup>st</sup> Century

## Wiring a New Norm

BY JOE ANIS  
President & CEO  
GE Gas Power Systems, GE Power MENA & South Asia



136, That's the number of years since inventor Thomas Edison unveiled a world-changing energy innovation – the first thermal power plant. Now, the world is in the midst of another evolution that will affordably meet low-carbon targets and the rapidly rising demand of 26% between 2016 and 2026.

The magnitude and location of electricity demand growth aren't the only things transforming the 21st century power landscape. At the highest level, change is being driven by three powerful trends: the emergence of digital technologies, the arrival of increasingly affordable diversified power technologies and decarbonization through the maturation of renewable energy and energy efficiency. Traditional and emerging, physical and digital, large and small – all are converging to create a new 21st century power network.

The benefits are almost immeasurable. Essentially, as more sustainable, intelligent and customizable energy solutions become available, so will more low carbon and national growth opportunities. In the Middle East, both are critical to supporting the Paris Agreement and the economic diversification detailed in National Visions, respectively. But there's another key driver: improving energy security and therefore quality of life.

Laudable progress is already being made. Last August, Abu Dhabi's renewable energy company, Masdar, signed an Engineering, Procurement and Construction (EPC) contract to build the Dhofar Wind Power Project, marking the first large-scale wind farm in Oman

“Laudable progress is already being made. Last August, Masdar signed an Engineering, Procurement and Construction (EPC) contract to build the Dhofar Wind Power Project – the first large-scale wind farm in Oman and the GCC.”

and the GCC. Saudi Electricity Company (SEC) has started operating a combined cycle power plant in Waad al-Shamal Mining City, heralding the first ever gas turbine made in Saudi Arabia. The project was rolled out of GE's manufacturing facility in Dammam with more than 140 local suppliers and a 70% local Saudi workforce. The latter is especially valuable to supporting the national goal of Saudization. And in the UAE, the Hassyan project in Dubai will be a 2400 megawatt (MW) capacity coal-based power plant when construction wraps up in 2023 – the first such power plant in the region. The \$3.4 billion project will play a vital role in supporting the country's Clean Energy Strategy 2050, which aims to diversify sources of power generation to incorporate 44% clean energy, 38% gas, 12% coal and 6% nuclear across the UAE by 2050.

But ensuring long-term energy security means much more progress is required in the Middle East and beyond. More 'out of the box' thinking will increase the number of innovative technologies and progressive

policies in the ever-growing treasure trove of energy efficiency. For example, the number of electric vehicles (EV) on roads worldwide rose to a record high of 3.1 million in 2017, with 125 million EVs by 2030, according to the International Energy Agency (IEA) in January. But heightening ambitions and strengthening policy as per the EV30@30 Scenario could see 220 million EVs on the road within the same period – a staggering 83% more.

GE technology already helps create one-third of the world's electricity, equipping 90% of power transmission utilities worldwide and serving more than 180 countries – roughly 90% of the globe's nations. With such responsibility, we must not simply keep pace with demand but rather anticipate it, to ensure energy security. Other players, big and small, must adapt the same proactive mindset. Succeeding in this new, networked energy landscape requires the nimbleness of a start-up and the wisdom of experience feeding into each other. There are no limits to innovation and there is plenty of room for everyone. We're just getting started.





# Digital Technology Adoption

## Unlocking Efficiencies in Industry

BY MORGAN ELDRED

Managing Partner, Digital Energy; former Research Director, Gartner; former Head IS Strategy & Risks, Maersk Oil; former Capital Projection Manager, Shell



Energy transition within the Middle East will be accelerated through three key digital technology trends: the Industrial Internet of Things (IIOT), energy efficient digital architectures and 3D printing.

Recent advancements in the IIOT, although primarily created outside of the energy industry, have been adopted by energy firms into their own operations, leading to breakthroughs in efficiencies. The main focus has been on reducing the energy that facilities require for heating, cooling, ventilation and lighting. Other uses have been to measure and optimize the energy used for extraction and

processing energy and for transportation of structural materials within the supply chain.

The American Council for an Energy-Efficient Economy (ACEEE) has estimated potential savings of 12%-22% of all energy consumed through the use of the IIOT. For example, Germany's Daimler reported a 30% improvement in energy efficiency for its robot systems, while Canadian Forest Products reported a 15% reduction in energy consumption by applying real-time alerts that indicate usage outside of anticipated norms. The largest reference case however is how

BlackHills Farms in New Zealand, which has managed a 50% reduction in cost in a little over a year as a result of lower energy and water consumption.

The IIOT is not one technology; it is a collection of technologies through the integration of sensors, cyber physical systems and smart algorithms. Energy companies require new energy efficient digital architectures to leverage this integration. The IIOT within the energy sector has primarily focused on increasing the reliability and integrity of physical assets. Typical implementation to date has focused on

“A digital trend that has tremendous benefits in enabling today’s energy transition? Additive manufacturing, also known as 3D printing. Investment is on the rise on research and development in this area.”

reduced maintenance and improved safety, leveraging aspects like acoustic monitoring of steam traps, condition monitoring of pumps and heat exchanger performance – all wirelessly connected. Other areas include supervisory control, data acquisition and analytics systems, providing cost-effective installation and paybacks of less than six months.

Case studies have indicated the difference in operating costs associated with these implementations at about \$12.3 million per year for a typical 250,000 barrel a day (b/d) facility. Assuming about 60% of energy operations are not operating as well as they could, the overall financial impact could run into billions of dollars annually.

Within the IIOT, new software tools focused on energy efficiency will allow two ways for energy facility management – open loop and closed loop. In the former, optimal set points manually

indicate the optimization variables and can achieve energy-cost reductions of 3%-8%. In the latter application, set points are sent directly to each optimizable variable and can achieve energy-cost reductions of 6%-15%.

Another digital trend that has tremendous benefits in enabling energy transition is that of additive manufacturing, also known as 3D printing. Investments for research and development (R&D) are on the rise in this area. For example, Sandia National Laboratories (a R&D center federally funded by the US government) is studying 3D printing for the production of wind turbine blades. 3D printing has the ability to produce materials used within the design of energy facilities that can significantly reduce the carbon footprint on the design, implementation and supply chain overhead used within the cost of construction.

**12%-22%**

The potential savings of energy consumed through the use of IIOT, estimates the American Council for an Energy-Efficient Economy (ACEEE).

**50%**

The cost reduction that BlackHills Farms in New Zealand achieved in just over a year.

**30%**

The improvement in energy efficiency Germany's Daimler has reported for its robot systems. Canadian Forest Products also reported a 15% reduction in energy consumption by applying real-time alerts that indicate usage outside of anticipated norms.

# Energy Transition

## Aspiration and Reality

BY DR. CAROLE NAKHLE

CEO of Crystol Energy; Member of the Governing Board of the Natural Resource Governance Institute; Visiting Lecturer at the Blavatnik School of Government at Oxford University, the University of Surrey, and Saint Joseph University (Beirut); Recipient of Honorary Professional Recognition Award from the Tunisian Minister of Energy, Mines & Renewable Energy



The topic of energy transition has caused an explosion of interest in recent years. It is the concept of a greener future through renewable forms of energy, such as biofuels, solar, wind, nuclear and hydropower. The Intergovernmental Panel on Climate Change (IPCC) said emissions from industrial processes and fossil fuels such as coal, oil and natural gas were responsible for an estimated 78% increase in total greenhouse gas emissions from 1970 to 2010. There are lofty ambitions within the energy transition towards renewables – and it comes with unique challenges and considerations.

Firstly, there is an equally important transition taking place which is often overlooked. Traditionally, one fuel has dominated the world's energy mix until another fuel has taken over. Coal, for example, replaced traditional biofuels and fuelled the first Industrial Revolution. More than half a century later, oil became king. Since the first oil shock in the early 1970s, its dominance has been gradually eroded as the share of natural gas has expanded. More recently, renewable energy has made its presence more notable. The main shift now is that over the next few decades, the world is moving into a more diversified energy landscape where no single fuel is dominant for the first time in history.

Secondly, energy transitions take

“For the first time in history, the world is moving into a more diversified energy landscape where no single fuel is dominant.”

time to fully develop. It can take several decades to get the right infrastructure in place, change behaviors, develop policies and regulations. Plus, the relative price signal of different energy sources should be right in order to enable the switch from one energy source to another.

Third, a joint report by the International Energy Agency (IEA) and the International Renewable Energy Agency (IRENA) in 2017 shows that the energy transition towards a greener future is consistent with limiting the rise in global temperature to well below two degrees Celsius. The report explores various low carbon technologies that do not necessarily exclude fossil fuels. In this respect, the effort that oil and gas companies are making in reducing the environmental impact of their activities and products – all while remaining competitive – should not be underestimated. Manufacturers of conventional internal combustion engines are placing equal emphasis on making their cars more environmentally friendly. Advances in such areas will surely improve on current carbon emission levels. But at the same time, they will

also delay the progress of green energy dominance.

Finally, for some countries, the energy transition, as per the current understanding, may simply backfire. This is particularly the case for petroleum-dependent economies, including the Gulf countries. Investments in alternative sources of energy still have a very long payback period and will continue to require strong government support for the foreseeable future. The problem here is that financial investment has to be funded by oil and gas revenues in petroleum-dependent economies with a dominant public sector. Even when money does come from private investment, it is typically triggered by explicit or implicit government backing. The result is a vicious cycle – to sustain a clean energy transition requires more, not less, hydrocarbon investment and production for as long as clean energy is not cost competitive. To facilitate the energy transition in such economies, economic diversification should therefore be the primary goal of governments before committing to ambitious clean energy plans.

78%

The increase in total greenhouse gas emissions from 1970 to 2010 from industrial processes and fossil fuels, such as coal, oil and natural gas, detailed the Intergovernmental Panel on Climate Change (IPCC).

17%

The growth rate of renewable power worldwide in 2017. This is higher than the 10-year average and the largest increment on record, according to BP.

80 GW

The target of combined renewables capacity across all countries in the region by 2030 based on countries' National Visions.

80 GW

The combined increase in renewables capacity across all countries in MENA by 2030, based on countries' National Visions.

[www.irena.org/mena](http://www.irena.org/mena)



## Underpinning 'Solar Arabia' with Petrodollars

BY GAURAV SHARMA

Independent Oil Analyst & Editor; Columnist – Commodities, Oil & Gas and Investing; former Business Editor, IB Times UK Newsweek Media Group; former Oil Markets Analyst & Desk Editor, Sharecast; former Oil & Gas Analyst/Features Writer, IJ Global



The oil price climate is relatively benign at the moment for Gulf crude producers. The days of three figure oil prices may not return in the immediate future, but oil benchmarks Brent and West Texas Intermediate have oscillated in the \$60-\$80/bl range for most of 2018. The upper cap of the range marks the highest prices on record since the fourth quarter of 2014. For many powerbrokers in the GCC with low carbon and regional energy diversification targets, nothing could be better.

While an inexorable march to a low carbon economy is visible in the Middle East, policymakers have the comfort of

knowing that demand for oil will continue to grow over the coming decades. Studies by the International Energy Agency (IEA) support this claim with Executive Director Dr Fatih Birol opining that even if one in every two cars is electric, crude demand would keep growing. That's because much of the demand is driven by aviation and petrochemicals, not by automobiles.

The concept of 'Solar Arabia' bankrolled by petrodollars is gaining currency. The theme first promoted by policymakers in Saudi Arabia has actually been adopted in earnest by the government of UAE and is the subject of much navel gazing in the

GCC. A cursory look around Dubai and Abu Dhabi would reveal both Emirates increasingly peppered with solar panels, arrays and renewable energy projects in a matter of years after the UAE ditched fuel subsidies during the oil price slump of 2015-2016.

The UAE is also in the process of building the world's largest single-site solar thermal plant, which will combine a central tower and parabolic trough technology to harvest energy from the sun, store it in molten salt and produce steam to generate power. The lead sponsor – Dubai Electricity & Water Authority (DEWA) – is aiming for

"The concept of a 'Solar Arabia' bankrolled by petrodollars is gaining currency. The theme first promoted by policymakers in Saudi Arabia has been adopted in earnest by the government of the UAE."

700 megawatts (MW). It claims the plant will deliver electricity 24 hours a day at a levelized tariff of USD7.3 cents per kilowatt-hour (kWh), which can "compete with fossil fuel generated power without subsidies."

It demonstrates policymakers' willpower as well as international and regional collaboration, with both China's Silk Road Fund and Saudi Arabia's ACWA Power Barka being stakeholders in the project. Yet, the poster project does little to demonstrate speed of execution if 2020 is deemed a target year for wholesale energy diversification. More so, if the regional leader UAE is used as a benchmark with its commendable initiatives being miles ahead of what's afoot elsewhere in the GCC.

Of course, few can dwarf Saudi Arabia's grand plans for 7.2 gigawatts (GW) of solar power by 2019, and a whopping 200 GW by 2030, with a project price tag of \$200 billion.

In March 2018, it inked a Memorandum of Understanding (MoU) with Japan's SoftBank to develop the grand project that is a hundred times larger than anything being planned anywhere in the world. In fact, going by Bloomberg New Energy Finance's (BNEF) data, the project would be bigger than the entire solar power generation capacity of France.

SoftBank's Vision Fund will invest \$1 billion in phase I of the project with not much concrete information on where the rest of the mammoth investment will come from. Realistically, it cannot be bankrolled by Saudi petrodollars alone. Furthermore, it would require Riyadh to completely upgrade its power grid to handle the incremental wattage. That is not to suggest that it cannot be done. However, healthy skepticism is needed until the first gigawatts fire-up the Saudi grid before 2020, and by extension much of the GCC.

### 700 MW

The aimed capacity of the world's largest single-site solar thermal plant to be built in the UAE. Lead sponsor DEWA claims the plant will deliver electricity 24 hours a day at a levelized tariff of USD 7.3 cents per kWh.

### 1/2

Even if one in every two cars is electric, the IEA believes that crude demand would keep growing.

# Lowest-Cost Oil Producers

## Manage Resources Like Any Other Commodity

BY SIR MARK MOODY-STUART

Chairman of the Global Compact Foundation; Chairman of the Innovative Vector Control Consortium (IVCC); Member of Board of Directors of Saudi Aramco Former Vice Chairman of the UN Global Compact; Former Chairman & Managing Director of Royal Dutch Shell; Former non-Executive Chairman of Anglo American plc



For normal commodities like iron ore or copper, the lowest-cost producers command the largest market share. Oil has not behaved in this way since the early days of OPEC in the 1960s because the lowest cost producers restrained their production, keeping the price of oil well above the marginal cost of supply. This enabled cycles of higher cost non-OPEC developments, successively in the UK North Sea, Alaska North Slope, deep-water offshore and most recently shale oil production.

With continued growth of demand, low-cost Middle East producers have generally been able to satisfy their domestic social and development income requirements without growing market share. Time and again, the bulk of volume growth has been taken up by non-OPEC producers. The great energy transition that is now underway may be about to change this approach.

Different analysts' estimates on when 'peak demand' for oil will occur vary by several decades. But there is some agreement that there is likely to be a period of flat or little demand growth for oil before any decline. Thus, instead of comfortably sharing a reliably growing pie, all producers will have to compete for a finite market. Of course, even when oil demand is flat, significant new development will still be needed to offset the decline of older fields. However, it does mean that in the longer term, all producers will compete for market share of fixed or reducing demand.

“Instead of comfortably sharing a reliably growing pie, all producers will have to compete for a finite market.”

In the short term, the picture is complicated by the very large number of higher cost non-OPEC projects that were cancelled in the light of the 2014-2015 oil price downturn.

The downturn and the energy transition have also had a significant impact in the thinking of the private sector. Despite the recovery in price, companies are now increasingly only prepared to sanction projects with break-even prices at levels well below \$50. As we have seen in the past this caution may be short lived, but it provides an opportunity for truly low-cost producers to invest to increase capacity.

So, what is holding them back? There are two factors.

First, low-cost producing countries face increasing demands on revenues, not only to meet the investment needed to transform their economies, but also to meet demands for social transfers to satisfy the understandable expectations of the population. Second, OPEC's low-cost producers are understandably concerned that signalling a willingness to invest to increase capacity and thus potentially market share will have a negative effect on oil prices and so have a net negative effect.

This is a familiar dilemma for low-cost producers of other commodities. Hence, the good news for low-cost oil producers

is the existence of a tried and tested roadmap.

First, there must be a willingness to invest in new capacity that may not be immediately required, or that is brought on stream in a phased way. Saudi Arabia has long adopted this policy in the interests of market stabilization. Second, there must be a clear signalling of the capacity to make such investments in very low-cost production environments, sending a clear warning to higher cost producers. Plus, it communicates a carefully expressed desire to maintain prices and production discipline.

This moderate approach should be coupled with a more aggressive willingness to utilize spare capacity whenever necessary to prevent a sudden increase in prices, linked to a cautiously upward movement of market share. Production brought on line should only be closed again in response to a price dip. While complex in the context of an organization like OPEC and the need for cohesion, such an approach has been practised for many years with some success by major commodity producers, admittedly with occasional price dips caused by misjudging the situation.

I commend this approach to all truly low-cost oil producers. They have carried higher cost producers for too long.



70%

The percentage of global energy investments that will be government-driven, meaning energy decisions will be primarily government-led, according to the IEA's World Energy Outlook 2018.

\$11bn

Investments in renewables across the Arab region in 2016, compared to \$1.2 billion in 2008 – a nine-fold increase in just eight years.

13%

Percentage of EVs that the World Energy Council said will be on the road in 2040, compared to the current 1%.

Issued by: HSBC Bank Middle East Limited U.A.E Branch, P.O. Box 66, Dubai, U.A.E, regulated by the Central Bank of the U.A.E for the purposes of this promotion and lead regulated by the Dubai Financial Services Authority.

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