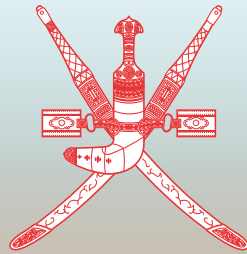


Whitepaper



OMAN ENERGY MASTER PLAN 2040 *Turning Climate Change Challenges into Opportunities*



How to Synergize All of Mankind's Challenges?

“ We must synergize all of mankind’s challenges [to effectively address climate change]. Today, we are talking in isolation. Meetings on food security do not discuss CO₂ emissions; meetings on youth unemployment do not discuss food security; meetings on CO₂ emissions do not discuss youth unemployment, and so on. Unless we bundle everything into one box and get a comprehensive discussion and debate going, we will not achieve our goals.”

H.E. Dr. Mohammed bin Hamad Al Rumhy
Minister of Oil and Gas, Oman



Ministry of Oil & Gas



Contents

- 02 Executive Summary**
- 04 GIQ Industry Survey**
- 06 Omani Youth Call for Action!**
Alena Dique, UN Conference on Trade and Development Youth, Representative of Oman
- 08 SNAPSHOT: Oman's Perspective?**
How Can the Sultanate Accelerate Positive Disruption?
- 10 INTERVIEW: World Must Try Harder. What's Next?**
Dr. Dominic Emery, Vice President – Group Strategic Planning, BP
- 12 SNAPSHOT: MENA Perspective?**
How Can Global Oil Leaders Champion Green Growth?

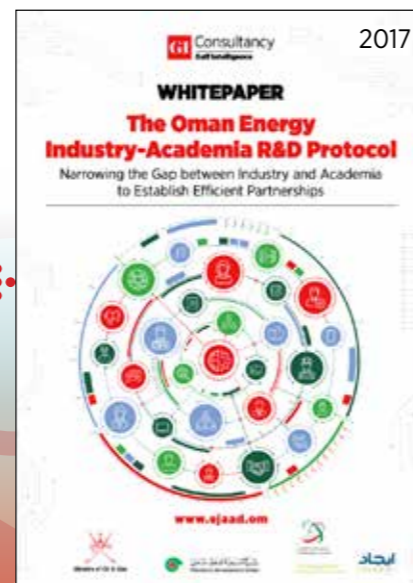
INDUSTRY INSIGHTS

- 14 Ejaad**
What's Next for Oman by 2025?
- 16 Oman Shell**
What Role will Natural Gas Play in the Global Energy Transformation and Oman's Climate Goals?
- 18 BP**
Building A Roadmap To Meet Oman's Climate Goals – Next Best Steps in 2020?
- 22 Oxy**
How can Oman's Energy Sector be Part of the Solution with Innovative and Lower Carbon Technologies?

RECOMMENDATIONS

- 24 Oman Energy Master Plan 2040**
Action Plan 2020 RECOMMENDATIONS
- 26 Campaign Timeline 2016-2019**

Building a Roadmap to Help Solve Oman's Energy Challenges One Year at a Time...



Report – Executive Summary

FORUM WORKSHOP – 12 INTERNATIONAL FACILITATORS

More than 300 stakeholders from the Omani energy sector came together for a one-day brainstorming session at the 7th Gulf Intelligence Oman Energy Forum on Nov. 25th, 2019. The focus was to craft an Action Plan on how the energy industry could support the sultanate as it works to achieve its commitments under the Paris Climate Agreement. The 20-session Forum was facilitated by a team of a dozen international experts:

- Myriem Touhami, MENA Program Manager, Finance Unit, Energy and Climate Branch, UN Environment Program
- Andrei Marcu, Managing Director, Roundtable on Climate Change & Sustainable Transition
- Dr. Aisha Al-Sarihi, Research Associate – Climate and Environment Program, KAPSARC
- Dr. Rasmi Hamzeh, Jordan Renewable Energy & Energy Efficiency Fund, Ministry of Energy & Mineral Resources, Jordan
- Abdullah Maghrabi, Senior Engineer – Corporate Sustainability, SABIC
- Otmame Benamar, General Manager – Engineering, GE Power
- Shelly Trench, Managing Director & Partner, Boston Consulting Group
- Dr. Dominic Emyr, Vice President – Group Strategic Planning, BP
- Dr. Aisha Al-Sarihi, Research Associate, Climate and Environment Program, KAPSARC
- David Galea, Partner, Ince & Co.
- Katie McQue, Energy Correspondent, Energy Intelligence
- Sean Evers, Managing Partner, Gulf Intelligence

\$6trn. This is the global economic value that can be unlocked by successfully adopting the energy transition up to 2050, according to Abu Dhabi-based International Renewable Energy Agency (IRENA). This is thanks to the very recent reversal of the world’s environment-economic narrative; a paradigm shift that will have ramifications throughout the 21st century (see: Low Carbon – A New Conversation). Within that \$6trn, opportunities to achieve *Oman’s Energy Master Plan 2040* abound.

Oman’s Next Move? A coordinated, multisectoral, innovative and scalable effort. This is what Oman must rapidly embrace if it wants to unlock the economic and environmental opportunities of climate change up to 2040, as per the *Oman Energy Master Plan 2040* and the National Vision 2040. But an urgent education process is also needed. A staggering 74% of *GIQ Industry Survey* respondents said Oman’s energy stakeholders are not aware of the low carbon targets included in Oman’s Intended Nationally Determined Contribution (INDC), which was submitted to the United Nations as per the Paris Agreement. Of equal concern is that 86% said they do not see the action required to be confident that the INDC can be achieved.

The oil and gas market has been the wind in the sails of Oman’s economic growth since the mid-1900s. But now a multifaceted energy basket offers a stronger, more sustainable future by utilizing



both fossil fuels and renewables. Meeting the sultanate’s rising energy demand and environmental targets – all at an affordable cost – will not happen automatically. Mammoth efforts are required to sustain momentum, especially supporting more public-private partnerships (PPPs), strengthening In-Country Value (ICV), nurturing more foreign partnerships and leveraging digitalization, as per the 4th Industrial Revolution.

The sultanate’s appetite for change is clear. It has made a good start leveraging its extremely fortunate geography and its progressive leadership is eager to ensure the words of the *Oman Energy Master Plan 2040* translates quickly into on-the-ground

#1 Energy Supply is one of the five themes in the *Oman Energy Master Plan 2040*. The top recommendation within this theme is: **Create, Adopt and Implement a Comprehensive Energy Action Plan that can Facilitate the Immediate Implementation of Renewables.**

Low Carbon: A New Conversation

Financial hurdles that long derailed global efforts for a lower carbon future are now emerging as financial opportunities; the foe has transformed into an ally. Today, embracing green growth (i.e. renewables, energy efficiency, circular economies) does not conjure fears of dwindling coffers and risk-hungry niche investors. The opposite is increasingly true. Global investment in new renewable energy capacity over this decade – 2010-2019 – neared \$2.6trn, detailed the *Global Trends in Renewable Energy Investment 2019* report. And up to 2050, solar power, wind power and batteries alone will attract \$10trn in investments worldwide, according to *Bloomberg’s New Energy Finance*.

Efforts Must Accelerate – Now.

Nearly half (46%) of respondents to a *GIQ Industry Survey* agreed that failing to act on climate change over the next five years would be a major threat to Oman’s energy and economic security by 2030. And global efforts so far are not enough – worryingly so. Even with the pledges made, the world is on track for between 3°C and 4°C of warming by the end of the century, according to the United Nations (UN). That is far above the 1.5°C of warming that a recent UN report warned would be devastating for the planet, triggering mass-scale food shortages, migration crises and fatalities. Imagine this global climate challenge is like the weather system; knowing no borders, all interconnected. By studying the weather, we can start to predict the next steps and use that information to apply solutions. That is the state of climate change: the more we learn, the more we can mitigate, the more we can prevent.



progress. This acceleration will be helped by the sultanate’s vast potential for solar and wind power generation, as well as land availability for large-scale projects and supportive government policies and frameworks (i.e. the *Oman Master Energy Plan 2040*, the National Vision 2040 and commitments to the Paris Agreement and Kyoto Protocol). While Oman’s goal to have 30% of its electricity demand generated by renewables by 2030 is ambitious, momentum for positive disruption makes it credible. For example, 41% of *GIQ Industry Survey* respondents agree that revising subsidies is critical to improve energy efficiency and generate funds for low carbon growth. They would be in favor of a monthly electricity bill to help combat climate change. The Structured Removal of Subsidies is the top recommendation of the theme on Energy Demand in the *Oman Energy Master Plan 2040*, illustrating the continuity of the sultanate’s efforts.

You Must Spur Change

Energy stakeholders cannot make the mistake of thinking someone else in Oman is addressing the challenge. The efforts of every individual counts. Making the *Oman Energy Master Plan 2040* a reality – including low carbon growth – means identifying and committing to the recommendations that emerge from key industry gatherings, such as the 7th Gulf Intelligence Oman Energy Forum. Only with this robust and clear roadmap, will the goals of industry, government, academia and the public be aligned by 2040. Accruing knowledge and applying lessons learned in quick time is the foundation of the *Oman Energy Master Plan 2040* and thus, a low carbon future. Ensuring all the boxes are ticked is extremely challenging – but non-negotiable.

2040 Environmental and Natural Resources combine to make one of the four themes in Oman’s National Vision 2040.

2 The theme of Environmental and Natural Resources has been broken down into two pillars. Broadly, one is ensuring ecological systems effectively protect the environment. The second is ensuring Oman has an efficient and responsible ecosystem i.e. effective oversight with a swift judiciary performance.

2005 Oman signed the Kyoto Protocol (broadly seen as the Paris Agreement’s predecessor) on 9 January, 2005.

2016 The sultanate ratified the Paris Agreement on 22 May, 2019. The agreement is seen by many as the last hope for humanity to preserve the foundations for a healthy planet.

2% In Oman’s Intended Nationally Determined Contribution (INDC) as per the country’s commitment to the Paris Agreement, the sultanate aims to achieve a 2% cut in greenhouse gas (GHG) emissions by 2030.

#1 Oman has the largest oil reserves of any non-OPEC country in the Middle East, according to the Gas Exporting Countries Forum (GECF).

74% of Oman’s government revenues come from oil and gas, according to the national budget.

50% Oman seeks to escalate gas production, shifting its oil-gas production mix from 35% gas in 2015 to more than 50% in 2025.

0.3% Following a recovery of 2.2% in 2018, Oman’s real GDP growth is estimated to decelerate to 0.3% in 2019, according to the World Bank.

9mn Oman’s population is set to climb by 45% to 9mn people by 2050, forecast the UN.

5th Global clean energy investments exceeded the \$300bn benchmark for the fifth consecutive year in 2018, reaching \$332bn, detailed Bloomberg New Energy Finance.



INDUSTRY SURVEY

Pursuing a Low-Carbon Economy?

Source: 350 Omani energy stakeholders participated in this exclusive survey in Q4, 2019, to help Oman build a roadmap towards a low carbon economy.

Omani energy stakeholders are sufficiently aware of the low carbon targets included in Oman's Intended Nationally Determined Contribution (INDC), which was submitted to the United Nations.

- A. Agree
- B. Disagree



The green economy could create more jobs in the Middle East than it destroys over the next 20 years.

- A. Agree
- B. Disagree



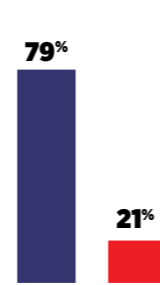
The President of Emirates Airlines, the biggest long-haul carrier, recently said that the airline industry was not doing enough to tackle climate change. Are we, in the Middle East energy industry, doing enough?

- A. Yes
- B. No



The energy transition and the Paris Agreement have the capacity to create more jobs than they destroy over the next decade to 2030.

- A. Agree
- B. Disagree



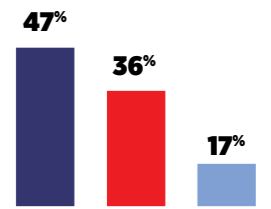
Nationally Determined Contributions (NDCs) represent the efforts of countries party to the Paris Agreement to reach the long-term goal of limiting global warming. Are you seeing enough action to be confident that this goal can still be achieved?

- A. Yes
- B. No



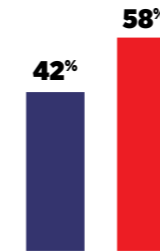
Which of the following stakeholders must lead in turning climate change challenges into economic opportunities?

- A. Government
- B. Industry
- C. Public/consumers



Oman will achieve its goal to meet 30% of electricity demand with renewable energy projects by 2030.

- A. Agree
- B. Disagree



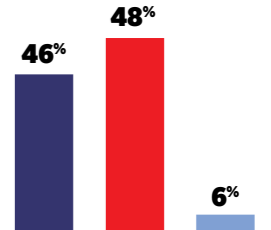
Putting a price on carbon is critical to achieving low carbon goals and spurring the green economy.

- A. Agree
- B. Disagree



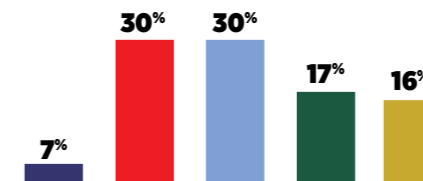
Failure to act on climate change over the next five years would be a _____ to Oman's energy and economic security by 2030.

- A. Major threat
- B. Minor threat
- C. Not a threat



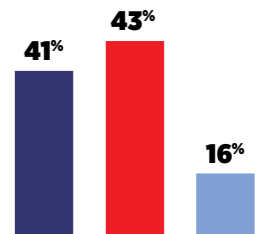
In its INDC, Oman committed to a 2% cut in GHG emissions by 2030. Which of the following could make the biggest contribution to meeting this target?

- A. Reduce gas flaring from oil industries
- B. Increase renewables in energy mix
- C. Increase industry's energy efficiency
- D. Legislation imposing low carbon limits
- E. Remove all subsidies



Subsidy revisions are critical to improve energy efficiency and generate funds for low carbon growth. How would you feel if your monthly electricity bill was higher in order to help combat climate change?

- A. In favor
- B. Not in favor
- C. No opinion



Omani Youth – Call for Action!



ALENA DIQUE
UN Conference on Trade and Development Youth, Representative of Oman

Ice caps are melting. Sea levels are rising. Temperatures are intensifying.

Global warming is very much here – so we must change our ways. In 2018, the Intergovernmental Panel on Climate Change (IPCC) stated that the world must halve CO₂ emissions to 2010 levels to achieve the 1.5°C. What does this mean for Oman? It means reducing CO₂ emissions to about 45,000 kilo tons in comparison to the original target in the Paris Agreement of 88,000 kilo tons – an additional 48% reduction.

But will even this be enough? Scientists warn that the North and South Pole ice caps are currently heating at 2.5°C. So, even if we achieve the 1.5°C limit, we are just slowing the earth's process of melting, not eliminating it. Today, less than 1% of

“I’m not scared because I don’t know what’s going to happen. I’m scared because I care about Oman.”

Oman’s energy sources come from renewables. But the sultanate has huge potential to generate solar and wind energy. Still, even if we were to harness all of it, we might only be able to provide 68% of current electricity consumption. Clearly, we must start looking at more alternative sources of energy. Partnerships will be key to sustainable development goals, as will transparency. The real change lies in the hands of the decision-makers.



Oman: What are we facing today?

Temperatures are rising, with the latest spike hitting 49.8°C in June 2018. Cyclones are more frequent, with the first in 1977, then in 1996 and 2007. Since then, eight cyclones have hit Oman. We are also seeing a change in the chemical composition of waters in the Arabian Sea. Fish, such as tuna and sardines, have stopped reproducing, which impacts the fisheries business. Plus, saltwater is mixing with ground water, which impacts the agricultural sector. And finally, sea levels are rising, which could see cities like Shafia, Al Wusa and Bakra being completely submerged. These are the changes happening naturally. Man-made challenges, such as plastics pollution, also need to be addressed urgently. When plastic decomposes, it breaks down into smaller particles. These expand in the heat, creating even more pollution. Another man-made challenge is food wastage. According to the Oman Animal & Plant Genetic Resources Centre (OFEGR), 18% of food intended for consumption in Oman ends up as waste. This is also an economic challenge; the value of this wasted food equates to 57mn Omani rials (\$148mn).



What’s the Good News?

In 2008, His Majesty Sultan Qaboos urged Omanis to investigate alternative means of power generation. Today, we have the innovative Miraah Solar Project and Dhofar Wind Project. And we are looking at new projects, such as the Solar 2022 Project and Oman’s first waste-to-energy conversion project. There is no doubt: Oman is making progress.



Leverage Talent

Overhauling wasteful energy production and consumption trends requires, in part, fresh talent with fresh thinking. Investing in Oman’s ICV – of all ages – is essential to unlocking opportunities.

4

Four major oil and gas companies in the sultanate have joined forces to boost the level of Omanization in key maintenance work on their facilities: Petroleum Development Oman, Oman Shell, Oman LNG and the Oman Oil-Orpic Group.

83,000

Since 2011, PDO’s Emdad initiative has secured more than 83,000 job, vocational training, redeployment, transfer, direct hires, ICV and scholarship opportunities and apprenticeship programs for Omani jobseekers.

2019

PDO exceeded its target of creating 21,000 such opportunities last year.

135,000

Striving to meet renewable energy targets by 2030, the GCC could create an average of 135,000 direct jobs every year. In 2030, jobs could reach 220,500, with Oman currently accounting for 7% of these, according to IRENA’s Market Analysis of the GCC.

78%

Comparatively, the UAE and Saudi Arabia combined account for 78% of these job opportunities, at 45% and 33%, respectively, detailed IRENA. The UAE’s total population is nearly three times larger than Oman’s.

OMAN'S PERSPECTIVE

How Can the Sultanate Accelerate Positive Disruption?



- Raoul Restucci, Managing Director, Petroleum Development Oman
- Eng. Omar Al Wahaibi, Chief Executive Officer, Nama Group
- Dr. Saif Al-Hiddabi, Assistant Secretary General for Research & Programs, The Research Council
- Dr. Yousef bin Hamed Al Balushi, Economic Specialist & Member of the Oman 2040 Economy & Development Committee

Moderator: How critical is acting on climate change to Oman's energy and economic security?

Raoul Restucci: It is an existential challenge that we must manage far more actively with far greater urgency. Subsidies are not sustainable, so there's an economic challenge. Plus, the employment opportunities are enormous and very much part of Oman's Vision 2040.

Eng. Omar Al Wahaibi: It is urgent that Oman makes sure that its infrastructure is secured in the next five years. The question is: do we spend the budget that we have on this, or on creating solutions for climate change?

Moderator: Oman must ensure its environment, its economy and its infrastructure. If you don't have power, you can't power economically.

“Regulators must be clearer on licensing and development parameters. Players, including those abroad, must know what is viable.”

Eng. Omar Al Wahaibi: In the electricity sector, we are using efficient gas turbines and moving to renewable energy, but we must invest in physically securing what we have today.

Dr. Yousef bin Hamed Al Balushi: Oman has challenges, such as water and food security, and a lot can be done on energy efficiency. We are moving in the right direction with our National Vision 2040 targets.

Job Creation: What's Next?

Raoul Restucci: There is massive scope to set up an In-Country Value (ICV) chain, plus create job opportunities regionally. Creating local supply chains and sustainable businesses in Oman by Omanis and products and services within country is critical. Oman not only has a geographical advantage in its political stability, but also in terms of the radiation intensity and wind opportunity.

Dr. Firas Al Abduwani: So far, we have typically been a consumer nation, rather than a knowledge-based economy. But platforms like EJAAD (see page 14) are helping us move towards this. We have an opportunity to not just create an internal supply chain, but also be creators of value that can be exported. We must select technologies that align with our human capital. Job creation is a major social pressure in Oman, so diversification from oil and gas into different sectors where our population can add value is very important. We are also behind when it comes to the intellectual property (IP) required for a direct transfer of technology.

49%
is the current youth unemployment rate in Oman. Job creation is an urgent need.

65mn
low-carbon jobs are expected to emerge globally by 2030.

2030
will see Oman's population reach 6mn people, with most Omanis between 20 years and 35 years of age.

Sources: GIQ, World Bank, 2019; UN, 2019; World Population Review, 2019



Moderator: In its INDC, Oman has committed to a 2% reduction in GHG emissions by 2030. What can be the biggest contribution to meet this target? Reducing gas flaring, increasing industry energy efficiency, legislation on low carbon limits or perhaps the removal of subsidies? Or is it by increasing renewables in the energy mix?

Raoul Restucci: Focusing on optimizing our systems and operations is an obvious target. That applies to society too, not just industry. Small investments in smart thermostats would reduce power consumption for air conditioning, for example.

Eng. Omar Al Wahaibi: Energy efficiency will not work unless there is a price and cost incentive and unless we remove or reduce subsidies. Subsidies encourage people to waste energy, electricity and food. However, it's also not practical to say that we can remove all subsidies today.

Dr. Firas Al Abduwani: Removing them could have catastrophic social repercussions if not done properly. But only by doing so, do you create value for renewable energy and drive benefits. We already see it in small scale solar projects in some Omani factories.

Raoul Restucci: Subsidy costs in Oman are \$2bn a year. That needs to be rationalized and applied based on social needs and redeployed into transforming industry.

Eng. Omar Al Wahaibi: Renewable energy is often talked about as a cost reducer, but this is a misconception. We are achieving lower wind farm and solar lamp costs, but this is only part of the equation. If we want electricity 24/7, a solar plant requires a gas turbine beside it to make sure there is enough cloud

SMEs thriving



“Some investments, like CCS and hydrogen experiments, are simply too large for small and medium-sized enterprises (SMEs). But energy efficiency is good value for any business and there are many other opportunities, such as carbon trading, that bring societal value. These are not always obviously transparent, but there is considerable working space to create SME financing to drive this industry far.”

– Raoul Restucci

“People are not going to change, unless we remove or reduce all subsidies. They encourage people to waste energy, waste electricity and food.”

cover to pick up the load. And when we add battery storage technology, the cost is larger than that of conventional energy today. This is the reality.

Dr. Firas Al Abduwani: We also need regulators to be clearer on licensing and development parameters. All players, including interest from abroad, must know what is viable.

*Edited transcript

INTERVIEW

The World Must Try Harder. What's Next?



“The consequences of not investing in a mixed energy basket would be truly tragic – both for Oman and the planet. Industry must remain optimistic, individual countries must play to their strengths and we must all leverage the technologies already available to us.”

Dr. Dominic Emery, Vice President – Group Strategic Planning, BP

Moderator: Governments are grappling with the interplay between cheap energy and energy access for all. What are the most critical actions to take?

Dr. Dominic Emery: Tangible investments have been made, but not enough. We need to work intellectually to build confidence that large scale deployment of low carbon opportunities can reduce CO₂ emissions, while providing fuel and food to those who need it. We can also create new employment to encourage research and development (R&D) and vertical collaborations across industry, such as looking at energy use in cement, steel and heavy transportation. Creating more of these partnerships would be extremely powerful. It's not just a matter of the production of oil and gas, it's about the way it's used.

Moderator: What would you say are the top critical actions that Oman must take to do more with gas?

Dr. Dominic Emery: Power is the easiest thing to decarbonize, particularly in places like Oman, which has fantastic solar and wind opportunities. This also applies to places, like Oman, that are transitioning from being a majority oil producer to majority gas producer. There is an emerging consensus that hydrogen will be an important decarbonized fuel. We can decarbonize natural gas with CCS to create hydrogen and that has multiple uses in industry, in heating and transportation. Oman can seize a leadership role in these areas.

“ We must work intellectually to build confidence that large scale deployment of low carbon opportunities can reduce CO₂ emissions, while providing fuel and food to those who need it.”

Moderator: What is the role of Oman's partners - the Shells, the BPs, the Schlumbergers – in accelerating its energy transition?

Dr. Dominic Emery: They could come up with very clear solutions, partnerships and projects. Government support will always be essential as an enabler. But rather than waiting for governments to develop the tangible opportunities that all players in the value chain can participate in, the private sector can also propose exciting projects that can build confidence.

Moderator: What best practice projects can we learn from?

Dr. Dominic Emery: There are several examples. We've seen collaboration between some of the car and fuel manufacturers in Europe. Around CCS, there are examples of collaborative projects that are

50%
Over the next 20 years, the world must reduce CO₂ emissions by approximately 50% in absolute terms.

7GW
Led by Oman, the UAE and Kuwait, a total of nearly 7 gigawatts in renewable power generation capacity is planned to come online in countries in the GCC by the early 2020s, detailed IRENA.

2030
Embracing digital technologies under the umbrella of the 4th Industrial Revolution could help reduce global CO₂ emissions by up to 15% – or one third of the 50% reduction required by 2030 – according to Ericsson's Exponential Climate Action Roadmap.



being developed across multiple industries. In terms of policy recommendations, notwithstanding the federal challenges around the Paris Agreement, the US has introduced production tax credits for wind and solar deployment that have been very effective in embracing money and confidence for deployment. In the UK, the use of a carbon tax has been very effective in bringing down energy intensity in the power sector. This now emits less than it did back in the 1970s and 1980s, so that is an extraordinary feature of good policy. The next decade is going to be critical. Next year, we will be taking stock on how we've done vis-à-vis Paris and the INDCs. The answer will be that we must try much harder – otherwise we won't make it. From BP's perspective, we are projecting ourselves out into the middle of the century, thinking of what the energy system could look like and how we can play effectively into that. There is no question that renewable power is going

“ Time is running out. We have had a few decades to turn these challenges into opportunities, so it is imperative to move quickly by actioning, for example, public and private partnerships.”

to be very significant under any circumstances, as well as decarbonized gas. But we also need to recognize that there will be important residual oil and gas production, ideally as the lowest cost of supply and with the best possible carbon footprint and energy efficiency.

**Edited transcript*

Top 2 Challenges of Climate Change?

- Reduce CO₂ emissions
- Alleviate poverty via access to energy

3bn
The number of people on the planet without access to clean cooking fuels, which creates another significant health and climate issue, said the UN.

1bn
Just under one billion people live without access to electricity, according to the International Energy Agency (IEA).

MENA PERSPECTIVE

How Can Global Oil Leaders Champion Green Growth?



- Dr. Rasmi Hamzeh, Jordan Renewable Energy & Energy Efficiency Fund, Ministry of Energy & Mineral Resources, Jordan
- Myriem Touhami, MENA Program Manager – Finance Unit, Energy and Climate Branch, UN Environment Program
- Dr. Aisha Al-Sarihi, Research Associate, Climate and Environment Program, KAPSARC

Moderator: There's concern that a commitment to carbon reduction has a negative impact on economic opportunity and employment. Would you agree?

Myriem Touhami: In Tunisia, there is a joint solar project between the government and private sector called PROSOL to.. produce renewable energy technology. We started this 12 years ago and have equipped thousands of households with thermal equipment and pipe systems to use renewable energy for electricity, creating more than 3,000 jobs in the process.

Moderator: Jordan gets a high ranking when it comes to progressing the energy transition, mainly because it has taken a rather aggressive approach. How can other countries be as ambitious while burdened by the legacy of national employment?

“ There must be a win-win for everybody. The government cannot ask the private sector to come in and implement a project on renewable energy technologies and not make money.”

Dr. Rasmi Hamzeh: We started our transition process five years ago to focus on green economic activities with renewable energy. Today, renewable energy is creating more jobs than the traditional oil industry. The government has been committed and there has also been a push from non-governmental organizations (NGOs) and the local private sector – all with a clearly defined plan. We now have 2,300 megawatts on our grid, as well as parallel investments in green economic activities. And we are working with local communities

354mn
Renewable energy targets at the national and sub-national levels are key. By 2030, the region could save 354mn barrels of oil equivalent – a 23% reduction – according to IRENA.



Spurring Green ICV

“The jobs we create using renewable energy technologies have the potential to be huge. In rural areas, for example, we can establish a renewable project locally to employ local people [rather than taking a power plant to them]. This enables local workers to stay in their communities [supported by a sustainable source of energy], instead of having to move to urban areas for employment.” – Myriem Touhami

to show them how renewables make their households and cars more affordable. Partnerships between the private sector, local communities and government are a must.

Moderator: What's the appetite of private financiers for the public sector and what returns are available?

Myriem Touhami: There must be a win-win for everybody. The government cannot ask the private sector to come in and implement a project on renewable energy technologies and not make money.

Moderator: Does the successful path of the energy transition have to be via public-private partnerships?

Dr. Rasmi Hamzeh: I believe it does. The government does its part in developing rules and regulations and we need the private sector for large scale investments, innovations and financings. In terms of convincing people to come on board when they are used to subsidized prices, it is also viable to subsidize renewable energy and green economic activities. This is what we do at my institution, the Jordan Renewable Energy & Energy Efficiency Fund. We focus on two issues: energy efficiency and supporting renewable energy systems.

Moderator: Is the Middle East energy industry doing enough on climate change? Is there enough data to conduct R&D and action tangible initiatives?

Dr. Aisha Al-Sarihi: One of the big things we are focusing on in Saudi Arabia is energy efficiency. For a

“ The Middle East energy industry needs to take more risk. It is a change of mindset and change is always difficult. They might lose some business while pursuing and promoting different business opportunities, but the rewards are immense.”

Myriem Touhami

long time, we had the cheapest electricity and water in the world, which translated into the unsustainable consumption. We have also studied CO₂ emissions, and this is now finally on the decline due to the regulations that have been introduced across different energy consumption sectors, like buildings, transport and industry.

Moderator: How can the regional energy industry accelerate solutions?

Myriem Touhami: The government must implement very clear and stable policies that do not change every two or three years, so that the private sector is encouraged and incentivized to invest. They also need to take more risks by promoting new and different businesses. The government owns the energy industry, so it can have a big impact on initiating the change in mindset and attitudes that is needed.

**Edited transcript*

22%
Meeting regional targets can also reduce the power sector's CO₂ emissions by 22% and cut water withdrawal in the power sector by 17%, IRENA detailed.

5
Jordan started its energy transition process five years ago with a firm focus on green economic activities and renewables. Today, the renewables market creates more jobs than the traditional oil industry. This counters fears that a diversified energy basket equals economic weakness.

80%
A large majority of the gas used in Morocco is subsidized; a story echoed across the MENA. Continually reducing subsidies, while ensuring socio-demographic support, is key to accelerating the energy transition and bolstering investors' confidence.

EJAAD:



شركة تنمية نفط عُمان
Petroleum Development Oman

What's Next for Oman by 2025?



“Oman needs an innovation ecosystem that is industrial, practical and sustainable – one that is always progressing. EJAAD is exactly that, with a bottom-line focus on national integration and measurable value creation. We must keep ‘feeding’ it with improvements and ideas to make sure it is always getting stronger. 2025 is not very far away; we must hurry.”

Dr. Abdullah Al Abri, Director, EJAAD

SOURCE: These Top Takeaways were harvested from 40 high-level Omani energy stakeholders during a roundtable event at the 7th Gulf Intelligence Oman Energy Forum in Muscat in mid-November. The session was held under the Chatham House Rule.

EXECUTIVE SUMMARY

An ecosystem that caters to a successful energy transition and economic diversification is ideally facilitated in a space where science meets commercial vision and entrepreneurial aspirations. This enables private investments and business opportunities to be channeled into human capital, R&D, robust policies and regulations. This promotes integration and assures resource optimization, sustainability and greater value realization. In Oman, this much-needed ecosystem is growing within EJAAD; established from the Gulf Intelligence Oman Energy Forum 2016 and launched in early 2018. Now in its third year, EJAAD is going a long way to answer key questions. How to solve Oman's key energy challenges in a timely and affordable manner? How to support economic diversification? And how to boost a knowledge-based economy, as per the National Vision and the Paris Agreement and rising energy demand?

EJAAD honors a shared vision of more than 50 stakeholders from industry, academia and government. It works to realize the mandates and aspirations of the Oman Energy Industry-Academia R&D Protocol, with the fundamental aim to encourage industry, academia and government to interact and engage.

But EJAAD must continually be improved to keep pace with the rapid change in the energy markets (i.e. the energy transition, green economy, the Paris Agreement, digitalization, geopolitics, shifting trade flows towards the east, rising populations and maturing and challenging oil and gas fields). The demands are too high for progress to slow. There must be signposts to the next best steps to sustain momentum; equal ‘stick and carrot’ as some roundtable participants said. So, what's next?

EJAAD Works To:

- ✓ Strengthen synergies between industry, academia and government.
- ✓ Establish technical and industrial-driven Centers of Excellence.
- ✓ Develop Knowledge Management as an essential component in knowledge-based economies.

TOP 5 TAKEAWAYS

1 Visible Leadership

Oman Vision 2040 aspires to build a productive and diversified economy that is fundamentally founded on innovation and the integration of roles. This will be an economy that is driven by the private sector towards synergy with the global economy and active contribution to global trade. The Vision 2040 strives to accelerate the transformation to a knowledge-based economy.

Before deciding what is next for EJAAD, it is important to reflect on global context.

Six out of top 11 highest worldwide spenders on R&D have a similar population to Oman (Finland, Norway, Denmark, etc). Up to 70% of their research efforts goes into the applied spectrum (R&D aimed at addressing specific challenges). Corporations and companies, globally and on average, contribute more than 65% of the spending in applied research. More than 50% of this contribution comes from the major operators and corporations of those nations. These statistics suggest that visible leadership is paramount for EJAAD (and the wider innovation ecosystem in Oman) to thrive. This applies to both government and industry.

■ **Government:** (1) Empower EJAAD to lead the innovation space, (2) Introduce national KPIs to governmental companies, ministries and agencies, (3) Introduce supportive policies that incentivize financiers and investors, (4) Create bridges to national tender boards.

■ **Industry:** (1) Introduce departmental and corporate KPIs to support EJAAD to continue to innovate and provide industrial products/solutions, (2) Frame opportunities to establish Centers of Excellence in the areas of focus, (2) Enable staff mobility, (4) Enable student internships.

2 Market Creation/Integration

Everyone realizes that STEM development is – and should be considered as – a national marathon, not a sprint. This marathon constitutes key components that include market size, market demand, educational and research systems, and others. It is always easier to start building an innovation ecosystem from areas of strength (technical and/or financial). The energy sector in Oman has that technical and financial standing and is leading worldwide on several fronts: thermal solar and enhanced oil recovery (EOR), to name a few. The combination of this sector along with national aspirations and tender boards, would ensure the required early stage adopters and developers of this innovation ecosystem. The fundamental law of diffusion suggests that for any initiative to thrive, the project must secure 15-20% early stage adopters to reach the tipping point for a mass rollout. Some countries go further and pay incentives to national and international players to achieve this adoption. What is next for EJAAD in this space?

1. To integrate the national manufacturing strategy and other related strategies.
2. To create an understanding of the corporate and national spend size and nature (category management) to see the best way to include innovation in product optimization, manufacturing and services. This is the practice of several countries such as; Finland, Norway, Morocco, China and South Korea, to name a few.
3. To create an understanding of the technology levels of these categories; low-tech, mid-tech and hi-tech.
4. To create markets that are needed elsewhere. EJAAD has already started efforts to work with international technology partners and potential off-takers for hydrogen, seaweed and others. These efforts can create completely ‘new and massive’ economics to Oman in the mid to long-term.

3 Complete Ecosystem

What keeps leading innovative nations ahead is the existence of a complete innovation ecosystem that spans the value chain. Getting the product to the market is more important than who solves it. The clock is ticking too loudly for egos to hinder progress. While EJAAD continues to develop itself to be the National Technology Platform for Oman, it must also:

70%

EJAAD is relevant to more than 70% of the Oman Vision 2040. Clearly, it is a fundamental, intellectual and progressive part of Oman's energy industry up to 2025 and beyond.

1/3rd

It directly applies to more than one third of the KPIs.

4

The four key objectives of EJAAD are to:
CONNECT: Link academic research to industry needs
PROMOTE: Uphold industry-industry, academia-academia and industry-academia collaboration
EXPLOIT: Maximize ICV by routing business R&D requests to local academia
ADD VALUE: Deployment, commercialization and technology transfer of research outcome

50

The Oman Energy Protocol was introduced under the umbrella of EJAAD and has now been signed by more than 50 stakeholders.

1. Integrate with the Investment Platforms.

This must allow investors and financiers to see the pipeline of projects coming up and will stimulate their appetite, potentially expediting progress.

2. Integrate with the People Platforms.

This will enable workforce development funds and entities (TFE, national Objectives, and others) in Oman to prepare the required workforce with the appropriate skillsets on time.

3. Integrate with the Startup/Accelerator Platforms.

This is a fundamental step to expedite business planning and the commercialization of products.

4. Utilize Knowledge Management as key enabler to:

- a. Drive the Global Innovation Index (GII) and the National Vision 2040 (V2040).
- b. Set up a team with TRC to drive and improve GI Indexes, V2040 related themes and others.
- c. Map out the role of each stakeholder on GI.
- d. Enable governance to drive/steer GI/V2040 and Global Knowledge Index.

4 Finance Matters – A Lot

Ideas and technologies will not thrive without financiers. Energy stakeholders in Oman, and on EJAAD, must make it easy for financial institutions (FIs) to support projects, including riskier, exploratory efforts. Those with acceptable risk-reward ratios, realistic funding projections, robust debt management programs and a strong awareness of the rising value of sustainability will garner more attention up to 2025. It's also important for FIs to engage directly with academia and industry (via EJAAD)

to expand on their expectations and willingness for different projects.

5 Deepen Global Alliances

Oman needs to market its capabilities, its offerings and its requirements much more loudly. Currently, the sultanate is whispering to the global market. Oman must ramp up its learning of energy models in other countries. What is next for EJAAD is to:

1. Cherry-pick the relevant available expertise in Oman (EOR, water management, etc), and ‘take them to the world’. This will accelerate the sultanate's progress in energy transition, economic diversification and make it a knowledge exporter. Oman, through EJAAD, must more actively promote the solutions it has discovered to the regional and international markets. This builds investor confidence in Oman's capabilities, attracting more competitively priced financings, and it makes the energy market a more dynamic career prospect for Omani youth.
2. Bring the world to Oman through strategic partnerships in projects, studies and pilots. This will ensure Oman can take advantage of the latest technological developments, while maximizing knowledge transfer and capability development.
3. Build strategic relationships with global powers and emerging economies. Oman shall capitalize on its diplomacy success, strategic location, availability of educated workforce to enable EJAAD to develop relations in science and technology with China, Russia and other countries.

**Not in order of priority*



عمان شل
Oman Shell

What Role will Natural Gas Play in the Global Energy Transformation and Oman's Climate Goals?



“The world is becoming more nonlinear by the day – gas markets must quickly change with it.”

Walid Hadi, Country Chairman, Oman Shell

SOURCE: These Top Takeaways were harvested from 40 high-level Omani energy stakeholders during a roundtable event at the 7th Gulf Intelligence Oman Energy Forum in Muscat in mid-November. The session was held under the Chatham House Rule.

EXECUTIVE SUMMARY

Gas is fast emerging as a foundation fuel of the future, a long-term bridge between the world's historical reliance on fossil fuels and its greener future with a mixed energy basket, in which renewables will be a strong focus. The intermittency of renewable energy – notably solar and wind in Oman – must be supported by gas to ensure energy security. Considered the ‘greenest hydrocarbon’, gas is also aplenty in Oman and the wider region; the Middle East is home to 40% of the world's natural reserves. Building an ever robust, scalable and sustainable gas ecosystem is critical to surfing – not crashing – through the uncertainty and opportunities of the energy transition. The same applies to meeting the sultanate's climate commitments, as per the Paris Agreement and the National Vision. The clock is ticking, so what are the next best steps?

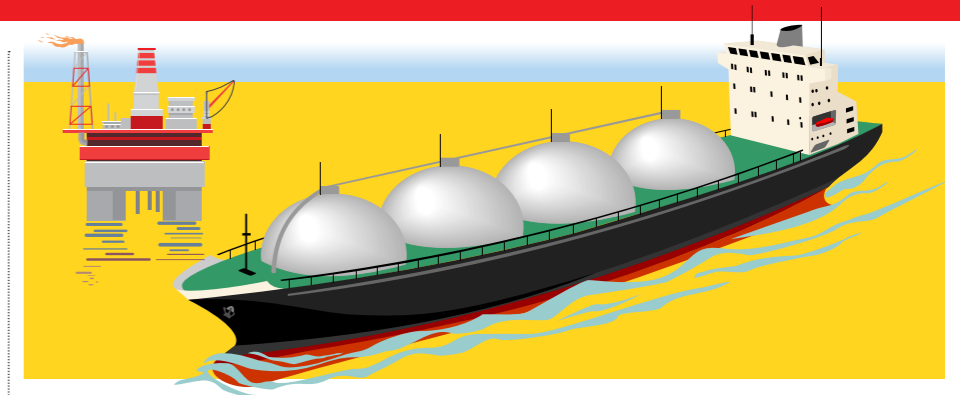


TOP 7 TAKEAWAYS

1 Establish a Carbon Footprint
Examine the environmental and sustainability of the full lifecycle of gas production, right from the initial drill through to retail. Shell calls this strategy ‘wells to wheels’. The total carbon footprint can be assessed and reduced where possible through a holistic lens so that environmental management in Oman's gas markets is done on a net carbon basis. How can Oman move this conversation forward?

2 Educate, Educate, Educate
The best way to educate young Omani minds on how to responsibly use energy, including gas and renewables, is to integrate it into their day-to-day environment. For example, Shell has a project where solar panels are installed at 22 schools in Oman. The same tangible learning experience applies to science, technology, engineering and maths (STEM) projects. This must extend past the theory, so students and young people – the energy champions of tomorrow – appreciate the cause and consequence of energy production and consumption. Building public awareness is also central to broadening employment opportunities within this field, thus supporting the National Vision to increase Omanization.

3 Invest in Hydrogen
Oman's growing focus on hydrogen is proactive, with government and private players promoting hydrogen as a fuel in transport and in large industrial areas, such as Sohar and Duqm. Generating hydrogen using large wind farms could be a strong focus area for Oman, ticking both renewable and energy security boxes. This will not happen overnight, however. Despite continued R&D, the affordable and scalable blueprints for the mass scale production of hydrogen are still some time away. Shell is piloting the first shipment of liquid hydrogen from Australia to Japan in 2020, illustrating capital intensive steps to try to de-risk or to mature hydrogen. How can Oman accelerate R&D in this space?



4 Bolster PPPs
The Omani government must continue working hard to strengthen the public-private partnership (PPP) ecosystem in the gas sector. Significant progress is being made. In 2007, the sultanate's upstream gas sector had one entity investing in it (PDO). Today, there are five major companies competing for projects, therefore accelerating the exploration and the appraisal of gas resources. How can Oman sustain and increase this positive momentum?

5 Energy Efficiency
Swathes of Oman's gas operations are not as efficient as they could, or should, be. Gas is still a hydrocarbon and, while an ally in the energy transition, efforts to reduce CO₂ emissions using principles of a circular economy and energy efficiency must remain pertinent. In 2018, primary energy intensity worldwide – an important indicator of how much energy is used by the global economy – improved by just

1.2%, the slowest rate since 2010. The 1.2% improvement in energy intensity equated to around \$1.6trn more GDP for the amount of energy used compared to 2017. However, this figure could have been \$4trn – an amount greater than the size of the German economy – had energy intensity improved at 3% every year since 2015. Losing potential savings in the gas industry from inefficiency is especially wasteful when the World Bank expects Oman's real GDP growth to decelerate to 0.3% in 2019, after a 2.2% recovery in 2018. Oman must squeeze maximum value.

6 Embrace Technologies
In the era of the 4th Industrial Revolution, new digital tools and technologies that can improve efficiency while increasing output abound – if managed correctly. Some pockets of Oman's energy industry remain conservative when it comes to utilizing these aids, viewing traditional tools as more reliable. This is not accurate, and the reluctance must be replaced with proactivity to sustain Oman's competitiveness in the global gas market. For example, companies using predictive analytics recouped \$7mn on gas pipelines in the US through predicting failures, according to Lloyds Register (LR). Muscat cannot turn its back on such savings.

7 Keep Rethinking Subsidies
It needn't only be a case of gradually removing subsidies entirely, but also reorganizing those funds and doing so in a way that garners public support. For example, instead of investing \$3bn per year in energy subsidies, half could be reinvested in supporting the energy transition. Positive and transparent marketing, explaining how this will preserve Oman's long-term energy and economic security, will help get the public on board.

**Not in order of priority*

74%
of Oman's government revenues come from the oil and gas industry, according to KPMG. Muscat must ensure its gas strategy remains relevant and competitive.

4.6mn
people live in Oman, with this set to rise by 45% by 2050, according to the United Nations (UN). Ensuring energy security amid a growing population, plus major industrial development (Sohar, Duqm), will only become more crucial.

2016
saw Oman ratify its commitment to the Paris Agreement, the world's most comprehensive climate-related deal that was crafted in the French capital in 2015.



BUILDING A ROADMAP TO MEET OMAN'S CLIMATE GOALS

Next Best Steps in 2020?



EXECUTIVE SUMMARY

Radical Change is Needed Talks Must Turn into Bellows!

Oman should master a double act: meet the ambitious goals of the Paris Agreement while meeting rising energy demand from a rapidly growing population. There are only a few decades available for the sultanate to carve out this new normal for its energy, financial and environmental markets. Stakeholders must not make the mistake of underestimating this challenge, nor the tight schedule.

The growth of affordable renewables, plus fossil fuel producers' willingness to venture into new markets, will help accelerate progress in Oman. For example, the cost of renewables has plummeted far more dramatically than the most optimistic forecasts anticipated. The levelized cost of electricity (LCOE) per megawatt-hour for onshore wind, solar PV and offshore wind have fallen by 49%, 84% and 56% respectively since 2010. That of lithium-ion battery storage has dropped by 76% since 2012, based on recent project costs and historical battery pack prices, according to Bloomberg New Energy Finance (BNEF). This justifies green investments and sets an optimistic tone for the next decade, for radical change is impossible without healthy investment attitudes.

But Oman – and the world – is still moving too slowly. At this rate, the global industry will fall short of the Paris Agreement targets. While efforts have certainly been made, much more is needed. In 2020, the talks of change must turn into bellows.

SNAPSHOT: MIDDLE EAST IN 2040?

The energy basket will become increasingly multifaceted, with the growth of renewables. But as our analysis show, fossil fuels will remain highly relevant for decades. Up to 2040, the Middle East will remain the largest oil producing region and the second largest gas producer, representing 36% of global liquids production and 20% of global gas production. Meanwhile, the share of non-fossil fuels in the Middle East's primary energy demand mix increases from 1% in 2017 to 13% in 2040 – half of the world's average (27%). ■ Source: BP Outlook 2019

“Oman Must Bundle its Challenges to Hit Targets”

Insights harvested from H.E. Mohammed bin Hamad al-Rumhy, Oman's Minister of Oil and Gas, at the BP Leadership Roundtable.



Oman's challenges are not linear – they are multifaceted and conflicting. On one hand, Oman must drastically reduce its CO₂ emissions to meet INDCs under the Paris Agreement, as well as national goals to improve the security of the sultanate's water-food-energy nexus. On the other hand, Oman must meet rising energy demand from industry and population, with the latter set to rise by 45% to 9mn people by 2050, forecast the United Nations. This all means changing how we teach, how we think, how we do business and our consumption habits. It will not happen overnight, but it will happen if Oman crafts a comprehensive roadmap.

Holism is best

Under the overarching umbrellas of climate and energy security are many more areas that Oman must urgently focus on. These stretch from food security and water security, to job creation and more. Resolving these individually will not work; Oman must zoom out to get a comprehensive view of how they are all interconnected. Everything must be bundled together

so all are educated on all the key challenges. Then, solutions that are sustainable and scalable must be applied.

For example, Oman cannot achieve the goal of food security without addressing energy availability and water security. Nor can it meet climate goals without better leveraging talent, the sultanate's fountain of intellect and creativity. Successfully identifying solutions also feeds into the National Vision of becoming a knowledge-exporter.

Collaborate, collaborate, collaborate

Such ambitious goals mean the objectives of the corporate world must be closely aligned with the objectives of the nation. For now, sometimes the government is going one way and industry another; two tunnels failing to interconnect or run parallel. The scale of the task ahead means these tunnels must meet and grow together. Oman has worked hard to gather all the pieces of the climate and energy puzzle; decades spent learning and finessing how to grow and monetise the energy

ecosystem. Now, we must all work harder to put the pieces together to find the solutions that will determine Oman's energy, environmental and economic future. Silos will only slow progress – and the ticking clock is our greatest challenge.

COMPETITIVENESS MATTERS

Sustaining Oman's competitive edge in the global energy markets is crucial; the oil and gas industry alone accounts for 74% of Oman's government revenues. Of course, the energy basket will increasingly diversify into renewables. But there's no doubt fossil fuels have been an economic engine in Oman's past and that they will remain pivotal up to mid-century. For example, BP Outlook expects the Middle East to be the world's second largest gas producer up to 2040, with gas called by many a 'foundation fuel of the future' and an ally in the rise of renewables. Unsurprisingly then, gas production (and improving the green credentials of the market) is a significant focus for Oman, alongside the broader energy basket. ■

TOP 5 TAKEAWAYS

What to Watch Out For in 2020?

SOURCE: These top takeaways were harvested from the BP Leadership Roundtable event at the 7th Gulf Intelligence Oman Energy Forum in Muscat.

1 Promote individualism under a holistic umbrella

There is no silver bullet for the radical change required to meet the Paris Agreement; every country is different. The sooner industry, government, academia and the public accept this, the sooner bespoke and effective solutions will be identified. Each solution must consider the natural resources available. This also applies to the INDCs, which are part of the Paris Agreement. Amid tension that INDCs differ hugely country-to-country, industry must remember that the Paris Agreement is not only an environmental agreement. It has far reaching economic and social impacts, as well. In Oman, the oil and gas industry accounts for 74% of government revenues. In the sultanate's case, it would be too economically, socially and politically damaging to turn away from fossil fuels in favour of renewables within a decade. The harm would exceed the benefit. Fortunately, Oman has the choice of diverse energy sources (strong potential for solar, wind and even hydro projects), which the sultanate can leverage alongside its established fossil fuel industry. But not every country has this benefit, nor the resources to spur the energy transition quickly i.e. talent, finance, R&D know-how and foreign alliances. Oman, and the wider Middle East, must start building a supportive cross-border ecosystem in 2020 that promotes knowledge and resource sharing to accelerate the region's progress.

2 Put a price on carbon (finally)

The lack of a global or industry-wide carbon price is disappointing. Well-designed carbon pricing – either a tax or a cap-and-trade system – provides the right incentives for energy producers and consumers alike to start radically cutting CO₂ emissions. In 2015, BP and other major oil and gas companies

(BG Group, Eni S.p.A., Royal Dutch Shell, Statoil and Total) called on governments worldwide and to the United Nations Framework Convention on Climate Change (UNFCCC) to introduce carbon pricing systems. They highlighted the value of creating clear, stable and ambitious policy frameworks that could eventually connect national systems. Alas, the calls have largely gone unanswered – wasted potential that industry and government must recapture in 2020. More recently, in 2019, BP and Shell gave \$1mn each to the Americans for Carbon Dividends advocacy campaign as part of a wider effort to get Congress to sign off on a carbon tax-and-dividend plan. Clearly, the road to putting a price on carbon – discussed for decades already – is a long one. The benefits will justify industry's perseverance. For example, a price on carbon makes energy efficiency

more attractive and makes low carbon solutions i.e. renewables and CCUS, more cost competitive. Any role Oman can play in building this momentum in the Middle East will be highly valuable.

3 Spur diversification of gas markets

The leading role of gas in the future energy mix means not only leveraging Oman's and the wider region's natural gas production (home to approximately 40% of global reserves). It must also mean diversification, from higher investments in the liquified natural gas (LNG) market, carbon capture, utilization and storage (CCUS) projects and the R&D of hydrogen markets. Oman's gas production levels are set to surpass oil by 2023 thanks to an impressive surge in the development of gas fields in the sultanate, according to Norway-based

independent energy research and consulting firm Rystad Energy. Gas production will reach 130mn cubic meters per day by 2025, shifting Oman's oil-gas production mix from about 35% gas in 2015 to over 50% in 2025.

4 Bolster leadership skills

Industry worldwide has recently developed a view that governments must take the lead and spearhead progress. This is no longer good enough; industry must do more to build confidence and action the region's energy, environmental and economic targets. One example of progress is the Oil and Gas Climate Initiative (OGCI), which led to members committing \$1bn to a new investment fund, OGCI Climate Investments, in November 2016. This was at the same time as the Paris Agreement – a government-centered

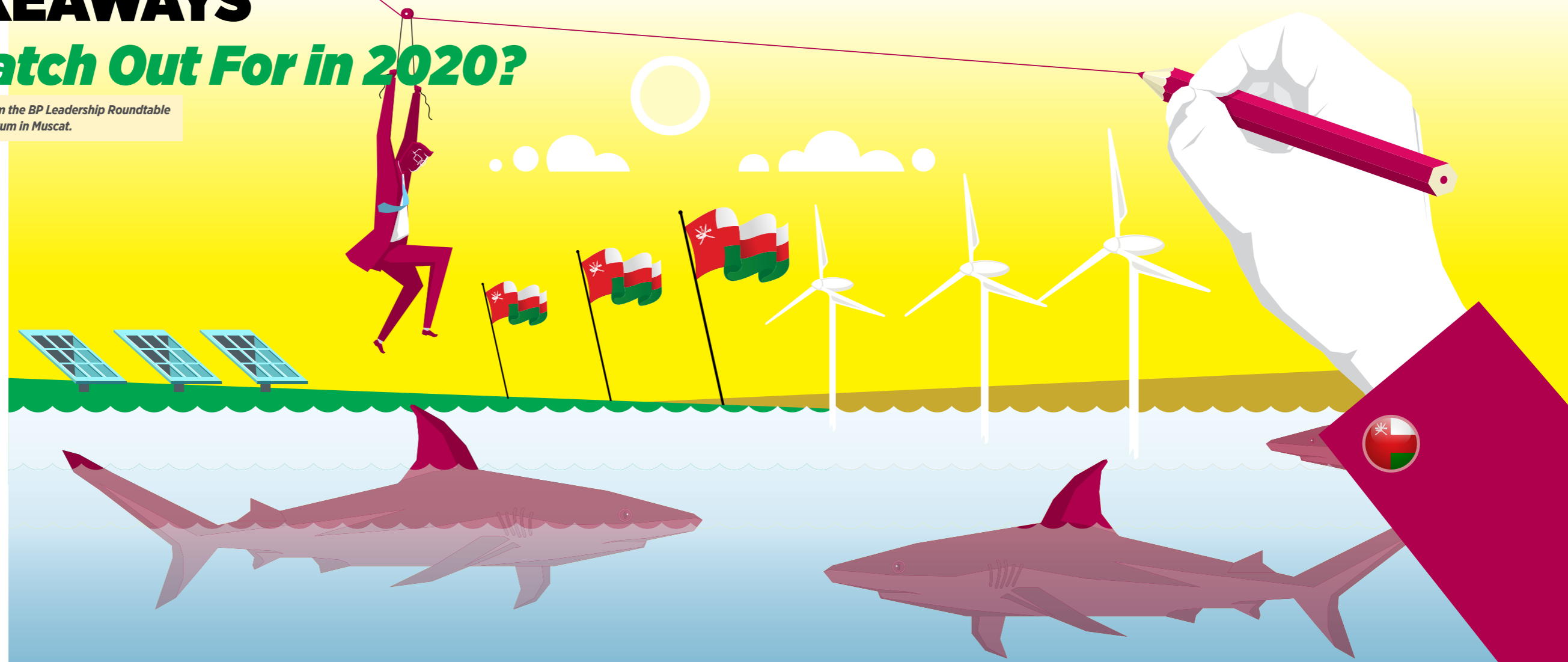
action – was gaining traction. This important step illustrates the power of industry's influence and can provide a template for further efforts in Oman and the wider Middle East. Such proactiveness is especially pivotal in harnessing investors' support – the linchpins in making climate targets a reality. An essential part of leadership must also be curating a culture of innovation and entrepreneurship within Oman's academia, industry and government. For one, embracing the learning and application of digital technologies would be instrumental in creatively, affordably and sustainably accelerating the energy transition. Digital technologies under the umbrella of the 4th Industrial Revolution could help reduce global CO₂ emissions by up to 15% – or one third of the 50% reduction required by 2030 – according to Ericsson's Exponential Climate Action Roadmap.

This corresponds to more than the current carbon footprints of the EU and the US combined, home to approximately 850mn people. Clearly, Oman must bolster its digital fluency in 2020.

5 Rethink economic realities

Industry must rethink its economic expectations. Seeking the impossible/unlikely will only disappoint investors and curtail the flow of much-needed funds. The returns that the energy industry historically enjoyed from oil and gas markets are simply not (yet) available in the current energy transition. That is not to say investments cannot be profitable, but they are unlikely to mirror the 25% return on capital employed that was seen in fossil fuel markets in the early 2000s.

**Not in order of priority*





Occidental of Oman Inc.
أوكسيدنتال عمان انكروپورت

How can Oman's Energy Sector be Part of the Solution with Innovative and Lower Carbon Technologies?

“Technologies that are valid today could very easily be obsolete in a few years. So, lower carbon technology investments must focus on collaboration, tailored solutions and adaptable intelligence to ensure the pipeline of new ideas remains robust.”

SOURCE: These top takeaways were harvested from 40 high-level Omani energy stakeholders during a roundtable event at 7th Gulf Intelligence Oman Energy Forum in Muscat in mid-November. The session was held under the Chatham House Rule.

EXECUTIVE SUMMARY

Don't make the mistake of thinking innovation is about money; it's about people. Their creativity, their incentives and their commitments. The climate goals as per the Paris Agreement and energy security amid rising demand cannot both be met without radically improved lower carbon technologies and digitalization, under the umbrella of the 4th Industrial Revolution (4IR). Oman, like most countries worldwide, must intensify its efforts to nurture a culture of innovation, which feeds directly into the growth of lower carbon technologies. Oman currently ranks 80th out of 129 countries on the Global Innovation Index 2019, down eleven places from 2018. The sultanate can't afford to slip further. So, what's next?

TOP 9 TAKEAWAYS

1 Streamline Operations: Optimize Efficiency

This is not a new conversation – millennia old, in fact – but it needs constant reminding. In our world of instant gratification, huge wastage and inefficiencies have become the norm. As illustrated by the political, economic and public momentum behind the Paris Agreement, this status quo must change. Lower carbon technologies that focus on bolstering efficiency (i.e. in line with the circular economy) will have the greatest and quickest success. Oman's Miraah project illustrates how new and mature energy markets – renewables and fossil fuels, respectively – can co-exist by innovatively using lower carbon technologies. Miraah uses solar PV to generate 6,000 tons of steam per day to support enhanced EOR operations at the sultanate's Amal field. The project supports energy security – fossil fuels will remain central to the energy basket well towards 2050 – while the saved CO₂ emissions are equivalent to taking 63,000 cars off Oman's roads.



2 Deepen Confidence in Local Solutions

Industry sometimes trusts international institutions more than local institutions. Reversing this view includes more collaborative and transparent communication in Oman, as well as positive marketing about what the local industry has achieved independently (i.e. patent registrations, ambitious projects for the sultanate's maturing oil fields, accessing challenging gas reserves, innovative EOR, etc). The need to build trust between local industry and local academia feeds into this. Academia plays the role of educator and knowledge creator, while industry is more of a hands-on solution provider that works to tight budgets. Intensifying market pressures mean it's time to meet in the middle to accelerate progress along Oman's value chain i.e. raise production output while improving affordability and sustainability, all at no cost to safety.

3 Identify Middlemen/Women

They must have overarching knowledge of industry, academia, government (plus the key themes of finance and digitalization) to create a 'common voice' in the industry when it comes to the advancement of lower carbon technologies. This will help streamline conversations between the stakeholders – especially amid the change of the energy transition – and plug gaps in knowledge quickly. Less confusion in the energy ecosystem is a win-win for all.

4 Strengthen Engineering Nows

Amid the excitement and opportunities of the 4IR, Oman's industry, academia and government must ensure local engineering talent continues to flourish. The sultanate needs Omanis who, in addition to fundamental engineering skills, can merge existing technologies with new, digitally enabled ones. This will only become more

\$12.5bn

today in worldwide revenues for artificial intelligence (AI) and cognitive systems alone are likely to climb by 55% to \$46bn by 2020, according to the International Data Corporation (IDC). How can Oman use AI to enhance lower carbon operations in the 2020s?

58%

of digital leading organizations in the region saw digital skills investment as the most important profit growth driver in 2018 and beyond, according to a study by SAP and Oxford Economics Digital Transformation Executive.

\$11trn

could be generated by combining the physical and digital worlds by 2025, McKinsey estimated.

2010

The levelized cost and electricity (LCOE) per megawatt-hour for onshore wind, solar PV and offshore wind have fallen by 49%, 84% and 56% respectively, since 2010, according to Bloomberg New Energy Finance (BNEF). Clearly, investing in green technologies in recent years is paying significant dividends.

4IR

is "a fusion of technologies that is blurring the lines between the physical, digital and biological spheres," according to the World Economic Forum (WEF).

valuable as energy companies in Oman become increasingly digitalized. Plus, nurturing local talent, especially those with coveted science, technology, engineering and mathematics (STEM) skills, is essential to support Omanization and the National Vision.

5 Boost Competitiveness

The ongoing removal of subsidies in Oman will create a more open market, giving more lower carbon technologies a chance to compete. But this must be done smartly. Removing subsidies, no matter how gradually, must keep being balanced by finding other comprehensive social-economic benefits to ensure public buy-in. This can include, for example, positive marketing on how the energy transition and lower carbon technologies can create more jobs.

6 Make Lower Carbon Technologies Socially Relevant

Accessible and relevant ideas are critical to public buy-in, which in turn is crucial to improve consumption habits and support for reduced subsidies. A homeowner, who can reap the financial benefit of solar panels on their roof, will be far more willing to change their energy consumption habits if they can appreciate the effort-reward ratio i.e. installing solar panels reduces monthly bills.

7 Pursue Energy Storage

Oman can, and should, accelerate its learning and R&D on energy storage, notably batteries. This will be a core focus of energy markets worldwide and critical to energy security, especially with the growth of the renewable market. The global battery market is anticipated to grow at a CAGR of 6.2% during 2018-2026, according to Polaris Market Research.

8 Shift Consumer Tactics

Oman needs to break away from predominately being a consumer of lower carbon technologies and innovations that are generated by others. The sultanate must be able to map out what lower carbon technology it needs and then tailor its actions to become an efficient, proactive and sustainable part of the national supply chain.

9 Top of the Pyramid Must Spur Greater Change

Innovators have long felt disenfranchised in Oman. The approach of 'happy to fail' – so central to curating a culture of innovation – is not strong enough. Influential stakeholders, notably government and industry, must encourage a mindset that is seen in Singapore, where finding new solutions and technologies is proactively facilitated.

*Not in order of priority

Turning Climate Change Challenges into Opportunities?

TOP 10 – STRATEGIC GOVERNMENT POLICY RECOMMENDATIONS

<p>1. ACCELERATE SUBSIDY REMOVAL: Energy efficiency – pivotal to low carbon growth – will fail without cost incentives. This includes hastening subsidy cuts in a rationalized manner, which supports various socio-economic demographics. Subsidies cost Oman \$2bn a year.</p>
<p>2. CLARIFY REGULATIONS: This is especially pertinent for clearer licensing and development parameters. Clarity will spur investors' confidence in capital growth – critical to supporting growth.</p>
<p>3. INITIATE POSITIVE CULTURAL DISRUPTION: Government must spearhead a cultural change within industry to encourage innovation, especially in state-owned companies. At the top of the pyramid for these companies, government can be especially influential.</p>
<p>4. ALIGN TECHNOLOGY DEVELOPMENT WITH AVAILABLE HUMAN CAPITAL: Focus on where the current Omani talent pool can add value in the field of technology and digitalization, thus supporting local business and nationalization. Strengthening Oman's intellectual property (IP) and transfers of technology supports the National Vision 2040 to become a knowledge exporter.</p>
<p>5. PROMOTE POSITIVE LINK BETWEEN LOW CARBON AND EMPLOYMENT: Low carbon will create, not eliminate, jobs. Sharing this message will counter fears that low carbon growth will weaken one of the sultanate's key employment sectors (energy), especially at a time of high unemployment. A Tunisian solar program, called PROSOL, has created 3,000 jobs in the last 12 years – such examples need a spotlight.</p>
<p>6. HELP LOCAL COMMUNITIES ADDRESS ENERGY DEMAND HABITS: Show how renewables can make households/transport more affordable and sustainable, thus reducing the fear factor of a low carbon future. Government-private sector-public partnerships are crucial.</p>
<p>7. CONSIDER SUBSIDIES FOR LOW CARBON/ENERGY EFFICIENCY PROJECTS: While reducing existing energy subsidies is vital, subsidies to specifically incentivize renewable projects/energy efficiency can accelerate initial adoption. As the low carbon market becomes more established, the subsidies can be revised.</p>
<p>8. INCREASE THE SUSTAINABILITY AND RELIABILITY OF POLICY-MAKING: Clear and stable policies that are not regularly revised (i.e. every 2-3 years) are in demand by a private sector seeking stability. This especially applies to big-ticket low carbon projects.</p>
<p>9. BUILD NATIONAL CONFIDENCE IN RELIABILITY OF RENEWABLES: Omanis' confidence that a low carbon future will be affordable, sustainable and not overhaul the sultanate's way of life is instrumental to building positive momentum. Strengthen awareness of how a greener Oman is a better Oman in the 2020s.</p>
<p>10. INCREASE INVESTMENTS IN RENEWABLES: Not only is this needed in order to hit national low carbon targets, but it also acts as a show of faith for local and international investors.</p>

*Not in order of priority

TOP 10 – INDUSTRY RECOMMENDATIONS

TOP 10 RECOMMENDATIONS	CHAMPION	SUPPORT	RECEIVED SUPPORT LETTER FROM MOG	IMPLEMENTATION UNDERWAY
<p>1. FOCUS ON DECARBONIZING THE POWER MARKET: This is one of the easiest parts of the energy ecosystem to decarbonize, especially thanks to Oman's abundant solar and wind power generation potential. Making significant headway will accelerate progress in parts of the energy ecosystem that are more reluctant to change.</p>				
<p>2. ACCELERATE DEVELOPMENT OF HYDROGEN: Hydrogen will be an important part of the low carbon fuel mix and has multiple uses in industry, heating and transportation. Oman can seize a regional leadership role in the hydrogen markets – if it acts quickly.</p>				
<p>3. SIGNIFICANTLY IMPROVE ENERGY EFFICIENCY IMMEDIATELY: The value of optimizing systems and operations is not a new idea, but the sense of urgency is. Despite multiple benefits, much potential remains unlocked. Low hanging fruits range from small investments in smart thermostats to reduce power consumption for air conditioning (AC), to predictive analytics to identify areas of operational inefficiency.</p>				
<p>4. QUICKLY GROW OMANI LOW CARBON BUSINESS CHAINS: Creating local supply chains and businesses by Omanis within country is critical to building sustainable momentum for low carbon growth. Success feeds into improving the low carbon ICV.</p>				
<p>5. STREAMLINE LOW CARBON SMEs' FOCUS AREAS: Some investments, i.e. in CCS and hydrogen, can be too large and complex for SMEs. To avoid failed starts and frustrated sentiment, SMEs should focus on energy efficiency instead, i.e. technologies and carbon trading.</p>				
<p>6. BUILD INVESTORS' CONFIDENCE IN LARGE LOW CARBON PROJECTS: Such projects are critical to building the scale of energy generation that is needed to accelerate the energy transition. Tangible successes (i.e. Oman's Miraah solar project) must be promoted as examples of robust risk-reward investments to incentivize financiers.</p>				
<p>7. SPUR INNOVATION-CENTERED LOW CARBON EMPLOYMENT: Talent development within industry must focus more on R&D employment, as well as more creative and vertical collaborations across all energy markets (with low carbon growth as a common thread).</p>				
<p>8. ENSURE ALL ENERGY INFRASTRUCTURE IS SECURE BY 2025: The fundamentals of energy security cannot be jeopardized amid times of significant change. Industry must ensure its energy infrastructure – renewables and fossil fuels – remains reliable and scalable for the next five years. Inaction carries consequences.</p>				
<p>9. LEVERAGE IOCs' STRATEGY SKILLS: International oil companies (IOCs) in Oman, as well as Omani companies, must more proactively develop structured and quantifiable low carbon plans that the entire value chain can engage with. Industry must be more ambitious in its strategic support of national goals.</p>				
<p>10. BUILD AWARENESS OF DIGITAL BENEFITS: Industry must first improve its knowledge of digitalization and then consider how to specifically apply it to their business. Only then is adoption advised. Poor understanding of how technologies and digitalization can merge to spur low carbon growth is wasting significant resources (time, funds, talent).</p>				

*Not in order of priority



Oman Energy Master Plan 2040 Progress & Implementation Timeline



2015

2016

2017

2018

2019

May 2015

Gulf Intelligence meets with the Ministry of Oil and Gas in Oman

"We need a long term Oman Energy Master Plan that delivers recommendations and solutions that are aligned with All stakeholders from Industry, Academia, and Government"
- Senior Government Official

Oct 2015

The 2015 OEF Industry Workshop

Two hundred national & international stakeholders from the Oman energy industry, and its associated ecosystem from academia, government, international organizations and the private sector gathered to answer the question: *What does Oman need to do to ensure that it is still a significant Oil & Gas producer in the year 2040?*

The answers revolved around five streams of study:

1. Energy Supply
2. Energy Demand
3. R&D
4. Labour
5. Water-Food-Energy Nexus

Jan 2016

Oman Energy Master Plan 2040 - Draft Report Published

The top three recommendations harvested from the OEF Industry Workshop for each of the key energy challenges addressed form the heart of the Oman Energy Master Plan 2040.

R&D Timeline

Q1 2016

Gulf Intelligence meets with Sultan Qaboos University and The Research Council to discuss the next steps in pushing forward the top R&D recommendation from the Oman Energy Master Plan 2040 which is "Align Academia and Industry in the Delivery of an Enhanced R&D Ecosystem in Oman."

Q2-Q4 2016

The Inaugural Occidental Oman Student Awards for the Advancement of Post-Graduate Education recognized four accomplished Winners (two, PhD, two Masters) at the Oman Energy-Industry Academia R&D Summit. The awards celebrate the country's future academia and industry leaders who will contribute to developing and enhanced R&D ecosystem in Oman.

Q4 2016

Oman Energy Industry-Academia R&D Summit Action plan created from the recommendations and solutions from The 2016 Oman Energy Industry-Academia R&D Summit & Whitepaper



Q1 2017

Special Leadership Summit with H.E. Dr. Mohammed bin Hamad Al Rumhy, Minister of Oil and Gas in Oman

Q2 2017

Drafting of Oman Energy Industry & Academia R&D Protocol Narrow the Gap between Industry & Academia to Establish Efficient R&D Partnerships

Q3-Q4 2017

Ratification of Oman Energy Industry & Academia R&D Protocol 40+ Institutions ratify The 2017 Oman Energy Industry-Academia R&D Protocol in an effort to build a vibrant research ecosystem within the country that can deliver the solutions that the energy industry requires to sustain output through to 2040 and beyond.

Q1-Q2 2018

Implementation of Oman Energy Industry & Academia R&D Protocol

Q3 2018

Research Project Implemented: Oman Energy Industry & Academia R&D Protocol Four research agreement to boost R&D collaboration between Industry & Academia in Oman signed between the Ejaad platform, Sultan Qaboos University and Petroleum Development Oman.



ENERGY TRANSITION Timeline

Q2-Q3 2018

Tanfeeth Energy Lab Oman's first Institute of Oil and Gas, Tanfeeth labs on energy, mining inaugurated.

Q4 2018

The 6th Gulf Intelligence Oman Energy Forum tackled the theme of How to Power Oman's Energy Transition Plan for the Future?



February 2019

The Leadership Summit brought together an exclusive group of senior stakeholders in Oman to be briefed on The Oman Energy Transition Action Plan. The senior leadership in attendance then ranked, in order of priority, the Top 10 Recommendations to be taken forward and implemented immediately.



November 2019

The 7th Gulf Intelligence Oman Energy Forum will tackle Oman's Energy Transition: Turning Climate Change Challenges Into Opportunities?



LABOUR - THE FUTURE OF WORK Timeline



"It's a very good piece of work, especially considering the participants that contributed. I think what will really help us is to make this piece of information available to the public"

- H.E. Dr. Mohammed Hamad Al Rumhy, Minister of Oil and Gas in Oman, comments on the Oman Energy Master Plan 2040 at the Special Leadership Briefing in Nov. 2016.

January 2017

Oman Energy Master Plan 2040 - Progress report One Year On

November 2017

Oman Energy Master Plan 2040 - Progress Report Two Years On



November 2017

The 5th Gulf Intelligence Oman Energy Forum tackled the Topic of 'The Future of Work and the Work of the Future' in coordination with the Oman Energy Master Plan 2040.



February 2018

The Leadership Summit brought together an exclusive group of senior stakeholders in Oman to be briefed on The Future of Work Action Plan. The senior leadership in attendance then ranked, in order of priority, the Top 10 Recommendations to be taken forward and implemented immediately.



May 2018

The Oman Employability Index Roundtable Brought together an exclusive group of key stakeholders to brainstorm the criteria and parameters that will form the heart of the index.

Gulf Intelligence hosts **Employability Index Seminars** with PDO; with OOC; with OPAL



May 2018

The Future of Work Action Plan captured the key recommendations that emerged from the Oman Energy Forum brainstorming sessions.

How to Accelerate Oman's Energy Transition?

TOP 10 – STRATEGIC GOVERNMENT POLICY RECOMMENDATIONS

<p>1. GOVERNMENT REGULATION TO IMPROVE DEMAND MANAGEMENT: Gov't policy and implementation of efficiency standards – be it for vehicles or domestic appliances – are hugely important enablers. The same applies to public buy-in, which requires comprehensive communication strategies to drive awareness on transition, especially when adjusting subsidies.</p>
<p>2. ACCELERATE POWER DEREGULATION & INTRODUCE SPOT MARKET: Oman should move to deregulate and privatize parts of its power infrastructure and introduce a spot market to allow for competition along all elements of the value chain.</p>
<p>3. ESTABLISH CLEAR LONGTERM TARGETS FOR RENEWABLES & ALIGN TAX RATES TO DRIVE INVESTMENT INCENTIVES: Oman should set clear targets that stretch out to 2040 and beyond, while at the same time correcting the current disparity in withholding tax rates on renewable projects between different countries. e.g. presently 5% on China & 10% on GCC.</p>
<p>4. OMAN SHOULD INCLUDE ALL INDUSTRIES IN ENERGY TRANSITION: Oman Energy Efficiency initiatives need to move beyond electricity and towards water desalination, transport and other industries – opportunities for decarbonization outside the power sector globally is 80%.</p>
<p>5. INCREASE INVESTMENT IN RENEWABLE ENERGY: Global investment in renewable energy needs to increase annually by 150% year on year for the world to meet the Paris Climate Agreement objectives – about \$16 trillion through to 2050 – so government policies should play a central role to ensure projects are bankable.</p>
<p>6. INTERNATIONAL DEVELOPMENT AGENCIES/ PUBLIC-PRIVATE: Oman should partner with international development agencies, such as the IFC/World Bank, to ensure projects follow best practice standards and so more easily attract other commercial funding.</p>
<p>7. RESOLVE OMAN GAS SHORTAGE: Oman needs to adopt renewables and other Energy Efficient – low carbon emission – solutions, such as CCUS and EOR, with greater urgency to prevent a gas shortage and free up gas for industrial development and export.</p>
<p>8. INTRODUCE FLEXIBLE REGULATORY FRAMEWORK FOR RENEWABLES: Install less restrictive terms & conditions in tender processes – currently companies have to have completed a minimum of two previous projects within the region to qualify, which drives international investors away, and quicker regulatory decision-making is needed to avoid abandonment of initiatives.</p>
<p>9. FIRST MOVER ADVANTAGE: Renewable energy is a relatively new field to the GCC which presents the opportunity to become a regional leader in technology development/deployment and export it – existing example is the proven technology of conversion of heat to produce hydrogen.</p>
<p>10. REMOVE ELECTRICITY SUBSIDIES: Remove/lower subsidies on water & electricity is essential to trigger end users to make rational choices and adopt energy efficient solutions (e.g. domestic smart meters) that private business are offering, which would simultaneously encourage SMEs and jobs growth in Oman.</p>

TOP 10 – INDUSTRY TO EXECUTE

TOP 10 RECOMMENDATIONS	CHAMPION	SUPPORT	RECEIVED SUPPORT LETTER FROM MOG	IMPLEMENTATION UNDERWAY
1. APPRENTICESHIP: Develop an apprenticeship program in partnership with industry in energy savings technologies for the Construction Industry.	GUTECH	ISHRAQ	✓	✓
2. CATEGORIZE & SUPPORT SMEs: Omani companies should broaden the tender process to facilitate SMEs which are an integral part of affordably and efficiently achieving success in Oman's energy transition -- support can be provided via on-the-job training (i.e. 'shadow SMEs' for a large company completing a tender) and in the categorization of SMEs' capabilities.	PDO	OCCI	✓	✓
3. NURTURE LOCAL SUPPLY-CHAIN CHAMPIONS: Bolster the respect and prestige associated with the wider local supply chain to encourage sustainable growth, including enhanced training, reducing the brain drain & boost commercial confidence.	Shell	OPAL	✓	✓
4. COLLABORATION AMONG INDUSTRY STAKEHOLDERS: Accurately monitoring and responding to supply-demand balances requires cohesion among industry stakeholders; even more so amid the shifting sands of the energy transition.				
5. REPLICATE LESSONS LEARNED IN OIL AND GAS: Many successful techniques to engage and grow the local supply chain have trialed and tested in the fossil fuels market. Do not reinvent the wheel; apply success stories to lower-carbon growth.	PDO	OMAN LNG	✓	✓
6. ADVOCATE VOCATIONAL TRAINING: Pairing a strong academic knowledge base with vocational training means university leavers can apply classroom knowledge directly to a project more effectively. Such efficiency will prove vital in SMEs' ability to not only successfully compete for bigger tenders, but also support the sultanate's energy security. The intellectual gap between theoretical and practical skills must narrow.	Shell	PDO	✓	✓
7. INTERNSHIPS - HARNESS LOCAL TALENT: People matter - investing in local capabilities will pay off. This broad spectrum encompasses better alignment between industry and academia, such as ensuring longer-term internships in the winter and not summer months.	PDO & MUSCAT UNIVERSITY	OOCEP	✓	✓
8. BUILD IN-COUNTRY R&D: Undertaking applied research project on solar panel efficiency to maximize the opportunity for rooftop solar in Oman. Building in-country R&D capabilities for wind and solar will allow SMEs to grab the opportunity presented by the inherent demand in Oman and build the economic supply-chain.	GUTECH	BP	✓	✓
9. LEVERAGE DIGITAL TOOLS: Digitalization & technologies can be leveraged more coherently to have a greater enabling role. Such tools are key in achieving scalability in the transition, such as when renewables will inevitably account for more than 15% of the overall grid. The same applies to creating a digital cloud to incentivize more FDI, therefore enabling a greater flow of ideas and funds to drive the energy transition.	OMAN LNG & MUSCAT UNIVERSITY	OOCEP	✓	✓
10. DRIVE PUBLIC AWARENESS ON TRANSITION: The mindset on energy transition still needs to shift – industry should work with the government to build general awareness of energy efficiency so that this is instinctively translated into measures taken across the economy and within households.	OPAL	PDO	✓	✓



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