



AT THE SHOW

Congress Programme

Power-To-X Innovation Forum

How Countries in the G20 Develop Better Policies for
Managing the Energy System

Far-reaching youth programme will inspire a new
generation of energy leaders

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Birol calls for greater mix

International Energy Agency executive director Fatih Birol urges Middle East nations to diversify their economies and look beyond oil and gas in the wake of the changing global energy landscape.

Pages 8&9

IEA executive
director
Fatih Birol
Photo:
BLOOMBERG



**UAE eyes 70%
cut in carbon
footprint**

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Congress Programme

Tuesday 10 September

08:45 — 09:00	Keynote address <i>Speaker:</i> H.E. Kersti Kaljulaid, Head of State, Republic of Estonia	
09:00 — 09:30	Keynote address <i>Speaker:</i> H.E. Awaidha Al Marar, Chairman, Abu Dhabi Department of Energy	
09:30 — 09:45	Keynote address <i>Speaker:</i> H.E. Saeed Mohammed Al Tayer, Managing Director and Chief Executive Officer, Dubai Electricity and Water Authority	ICC Plenary
09:45 — 10:00	Keynote address <i>Speaker:</i> Amin H. Nasser, President and Chief Executive Officer, Saudi Aramco	ICC Plenary
10:00 — 10:15	Keynote address <i>Speaker:</i> Jean-Bernard Levy, Chairman & Chief Executive Officer, Electricité de France	ICC Plenary
10:00 — 11:15	Opening plenary The new people power: Driving change for sustainable energy <i>Moderator:</i> Eithne Treanor, Energy Commentator, E Treanor Media <i>Speakers:</i> H.E. Eng. Mohamed Al Hammadi, Chief Executive Officer, Emirates Nuclear Energy Corporation (ENEC) H.E. Wei Kou, Executive Chairman, State Grid Corporation of China Alexey Likhachev, Director General, The State Atomic Energy Corporation Rosatom Kim Yin Wong, Chief Executive Officer, Singapore Power Ltd Dr. Martin Brudermüller, Chairman of the Board of Executive Directors and Chief Technology Officer , BASF SE Rachel Kyte, Special Representative of the U.N. Secretary-General; Chief Executive Officer, SEforALL Steve Berberich, President and Chief Executive Officer, California Independent System Operator	ICC Plenary
11:30 — 12:00	Break	
12:00 — 13:15	Parallel sessions Global dynamics of gas and unconventional Getting to grips with blockchain: Cutting through the hype New regional perspectives: Critical enablers to Africa’s energy transition Financing energy: Closing the clean energy investment gap The voice of cities: designing an energy smart future Cyber security: 3 clicks from collapse The power of people diversity	<i>Hall 4, Block 2</i> <i>Hall 4, Block 3</i> <i>Hall 4, Block 1</i> <i>Conference Room A, Block 5</i> <i>Conference Room A, Block 4</i> <i>ICC Fishbowl</i> <i>Conference Room A, Block 6</i>
13:00 — 14:15	Lunch break	<i>Halls 2&3</i>
14:30 — 15:45	Parallel sessions Dynamic resilience: Preparing for extreme weather, water stress and cyber risk Rethinking hydro: Powering tomorrow’s world To invest or divest: New realities and responsibilities Promise of solar Unlocking the potential of energy efficiency New regional perspectives: Asian prospects for a low carbon society New models of leadership: profit with purpose THE role of gas in the global energy transition	<i>ICC Plenary</i> <i>Hall 4, Block 1</i> <i>Conference Room A, Block 6</i> <i>Hall 4, Block 3</i> <i>Conference Room A, Block 5</i> <i>Conference Room A, Block 4</i> <i>ICC Fishbowl</i> <i>Hall 4, Block 2</i>
15:30 — 16:00	Break	
16:15 — 16:30	Keynote Address U.S. Innovation and Global Energy Security <i>Speaker:</i> H.E. Dan Brouillette, Deputy Secretary, United States Department of Energy	ICC Plenary
16:30 — 16:45	Keynote address <i>Speaker:</i> Lisa Davis, Chief Executive Officer Gas and Power, Member of the Managing Board, Siemens	ICC Plenary
17:00 — 18:15	Closing plenary The business outlook for oil <i>Moderator:</i> Helima Croft, Managing Director, Royal Bank of Canada <i>Speakers:</i> H.E. Mohammad Sanusi Barkindo, Secretary General , Organization of the Petroleum Exporting Countries (OPEC) Dr. Ahmed Ali Attiga, Chief Executive Officer, Arab Petroleum Investments Corporation Dr. Daniel Yergin, Vice Chairman, IHS Markit Musabbeh Al Kaabi, Chief Executive Officer, Petroleum & Petrochemicals, Mubadala Investment Company William Lin, Chief Operating Officer, Upstream Regions, BP	ICC Plenary
19:30 — 21:30	By invitation only Gala dinner	

Power-To-X Innovation Forum

On June 17th 2019, the World Energy Council held its first Innovation Forum (IF) on P2X, closely working with its German Member Committee.

The event, hosted by Norton Rose Fulbright, brought together over 50 energy leaders from 10 countries. During the day-long event, moderated by Dr Angela Wilkinson, participants shared expertise, ideas and concrete proposals to mainstream P2X as an enabler of decarbonisation.

The energy transition will require a mix of clean, low carbon electrons and molecules. However, most of the focus to date has been on greening power and promoting electrification.

Power-to-X (P2X), the process by which synthetic fuels are produced using power from renewable or other low carbon sources is a solution to fill this clean molecule gap.

P2X can be used to decarbonise sectors which electrification will have difficulty reaching, provide a long-term storage solution and green industrial and chemical supply chains. In the P2X conversation, the "P" is commonly wind, solar and geothermal and the "X" getting the most attention is hydrogen.

Participants ranged from policy makers to energy incumbents as well as new market entrants and investors.

They shared the conviction that P2X has a central role to play in decarbonising our economies.

Another point of agreement was that the P2X conversation cannot be based only on excess or curtailed renewable electricity.

Different perspectives emerged on the preferred pathway, as different countries have different priorities and societal preferences.

The consensus was that a clear vision should be set for P2X. While in the long-term the "P" should come from renewable sources, other power sources could support the development and economic viability of P2X in the interim.

Nuclear power may have a role to play, particularly if the waste heat generated might increase the efficiency of conversion.

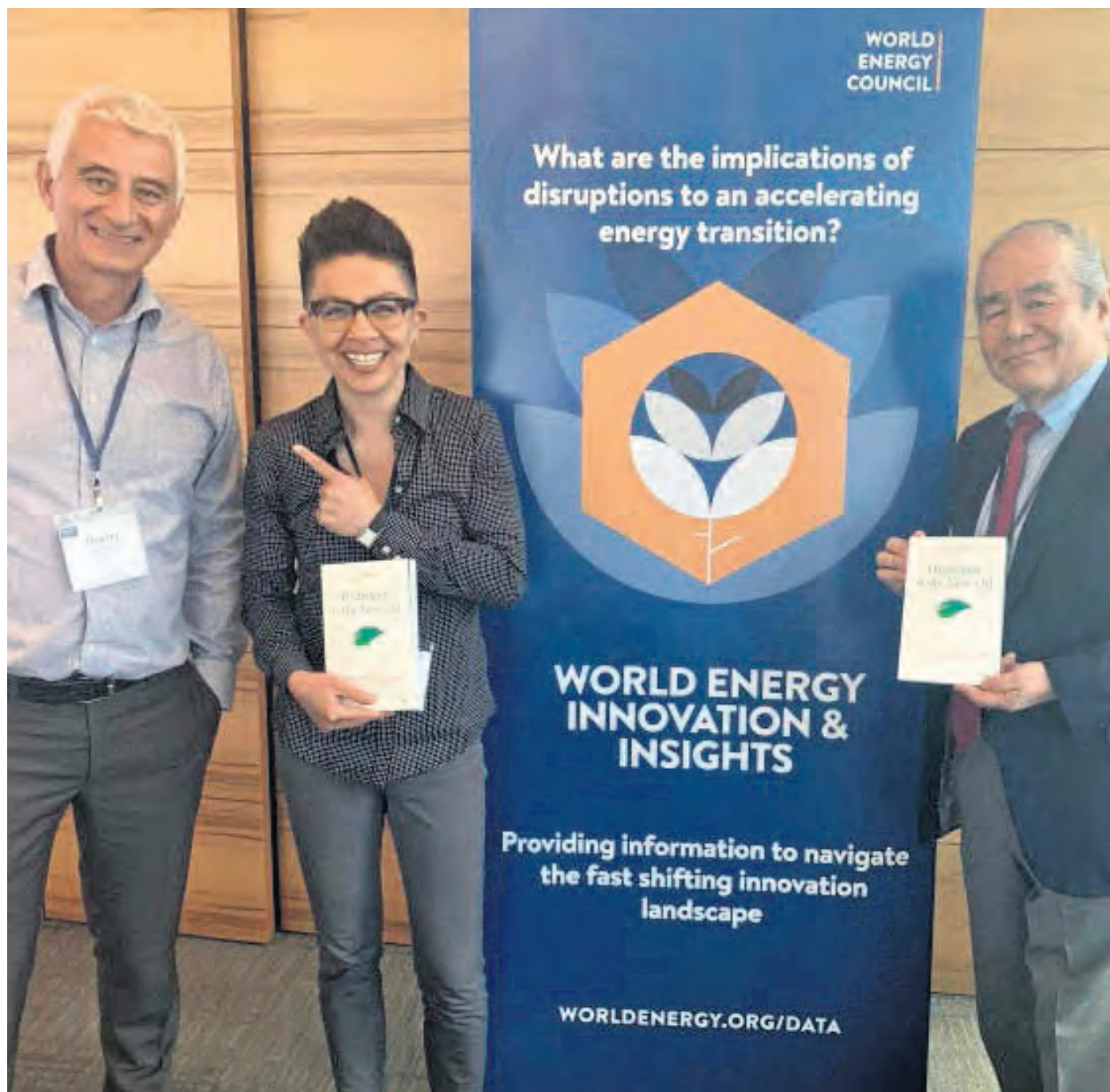
The "X" discussed included hydrogen, however ammonia, biomethane and liquid organics were also considered by attendees.

Two goals emerged for the World Energy Council from this Innovation Forum:

- 1: Enable an international alliance to promote international coordination on P2X;
- 2: Work with the private and public sectors to develop clear P2X commitments.

Key Insights

As installed capacity of renewable energy



Power-To-X Banner and Leaders

continues to grow around the world, P2X's opportunities become increasingly evident.

As noted by several participants, transporting an electron over-ground can be up to 10 times more expensive than transporting a molecule.

Importing clean fuels from countries with favourable P2X production conditions can help to reduce costs considerably for importing countries and sustainably support the energy transition.

Existing assets, including pipelines and salt caverns, could be re-purposed to transport and store clean energy. This would require a coordinated approach between industry and governments.

Today, over 60% the cost of producing

hydrogen using electrolyzers is the cost of electricity.

P2X's economic viability therefore largely relies on low power prices. Continued deployment of lower cost renewable generation and continued reduction in power prices is therefore important for the success of P2X.

Bold decarbonisation targets underpinned by a global carbon price were regarded as the main game changers for P2X.

The development of global renewable standard for X will also be important for the development of global markets

Next steps

This Innovation Forum set the

foundations for the creation of an international working alliance on P2X.

The biggest opportunities for creating an international P2X market are: i) trading clean energy in the form of gases or liquids; ii) developing a long-term energy storage solution, and iii) decarbonising sectors which electrification cannot reach cost-effectively.

P2X needs to overcome several challenges, including the lack of policy engagement and more generally, awareness around the topic.

The development of cost-effective transport solutions and the involvement of incumbents will unlock opportunities for P2X globally.

Innovation Insights Brief – New Hydrogen Economy – Hype or Hope?

Hydrogen and fuel cell technologies have experienced cycles of high expectations followed by impractical realities.

This time around, however, falling renewable energy and fuel cell prices, stringent climate change requirements and the discrete involvement of China are step changes.

The combination of these factors is leading to realistic potential for hydrogen's role in the Grand Transition.

Having conducted exploratory interviews with leaders from all around the globe, the World Energy Council is featuring eight use cases which illustrate hydrogen's potential.

These range from decarbonising hard to abate sectors such as heat, industry and transport to supporting the integration of renewables and providing an energy storage solution.

Dr Angela Wilkinson, Senior Director, Scenarios and Business Insights said: "Green and blue hydrogen can refresh those parts of the energy system transition that electrification cannot reach."

This Innovation Insights Brief is part of a series of publications by the World Energy Council focused on Innovation.

In a fast-paced era of disruptive changes, this brief aims at facilitating strategic sharing of knowledge between the Council's members and the other energy stakeholders and policy shapers.

WHAT IS HYDROGEN?



LIGHTEST AND MOST ABUNDANT

Hydrogen is the first element in the periodic table. It is the lightest, most abundant and one of the oldest chemical elements in the universe.

NEVER ALONE

On Earth, hydrogen is found in more complex molecules, such as water or hydrocarbons. To be used in its pure form, it has to be extracted.

FUEL OF STARS

Hydrogen fuels stars through nuclear fusion reaction. This creates energy and all the other chemical elements which are found on Earth.

How Countries in the G20 Develop Better Policies for Managing the Energy System

The World Energy Council recognises the value of adopting a whole energy systems approach in delivering the benefits of sustainable energy to all.

Energy transition is a connected policy challenge. Success involves managing energy security, equity and environmental sustainability throughout the transition process.

The Council's Energy Trilemma Index, developed with the support of Oliver Wyman, provides an objective rating of national energy policy and performance across these three dimensions.

In anticipation of the all-new Trilemma that will be revealed at the 24th World Energy Congress, we take a closer look at their national 'Trilemma triangles' and the associated policy choices and transition pathway performance.

Progress on pathways to sustainability

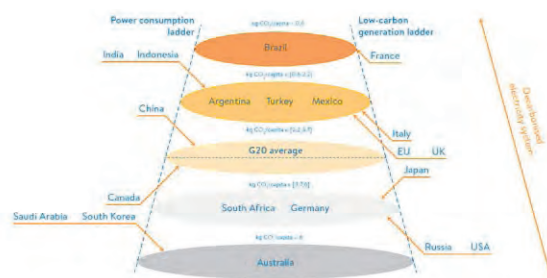
Managing multiple policy priorities is a challenging process that benefits from looking at synergies, as well as balancing trade-offs.

A deep-dive into Trilemma scores across the G20 countries provides important insights about the role of energy policy in sustaining energy transition.

Energy policy is an important lever for action in decoupling carbon emissions from economic growth, and in meeting shifting and new demand for heat, fuel and power in other sectors.

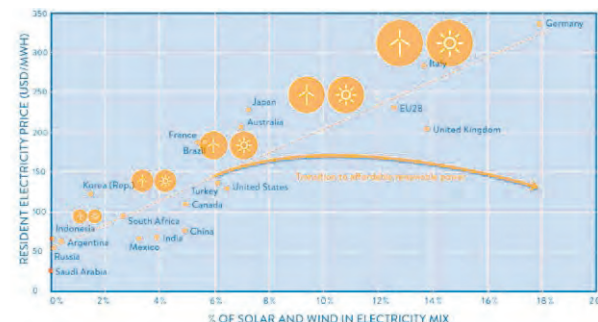
This is a high priority, as 39% of the G20's CO₂ can be attributed to electricity generation.

Tracking Trilemma performance over time shows that G20 countries follow two clear, but not mutually exclusive, routes to lowering emissions: decarbonisation of the electricity supply and reducing electricity demand.



G20 CO₂ emissions per capita. Some countries have not changed their emissions significantly, others have shifted between bands over the period 2006-2016

- European countries have made sustained efforts to decarbonise electricity production and manage demand, with the UK, Italy and France ahead with strong sustainability performance.
- Power demand is growing rapidly in India, Indonesia and especially China. While their power mix is decarbonising, it is happening at a slower pace.
- The rapid evolution is stark: in 2004, electricity-derived CO₂ emissions per inhabitant were twice as high in the UK than in China, whereas in 2016 they were twice higher in China than in the UK.
- Australia, Saudi Arabia, the US, Korea and Russia have the most carbon intensive power systems in the G20, due to a high share of fossil fuels in their electricity mix coupled with high power consumption levels when compared to other G20 countries.



Percentage of solar and wind in the electricity mix of G20 countries and household electricity prices (2016)

has led to a 27% decrease in CO₂ emissions from power generation in the EU between 2006 and 2016. However, feed-in tariff policies to help establish new technologies have contributed to rising electricity prices and growing concerns about the affordability of power and heat for households and industry. Several European countries have seen their Energy Equity indicators impacted by these trends.

• The increasing penetration of renewables in Japan, Australia and Brazil could place these countries on a comparable pathway although there is hope that the scalable cost efficiencies of solar and wind power will not impact equity.

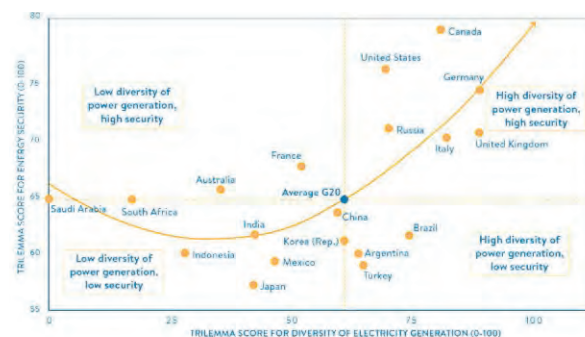
• China, India, and Mexico have significant potential to develop their solar and wind resources so that generation capacity from these sources could become cost competitive with thermal sources. Solar and wind generation has increased threefold in Mexico between 2012 and 2016 with electricity prices remaining stable over the period.

• The Trilemma Index tool can be used in combination with the Council's World Energy Scenarios for forward assessment exploring new opportunities in managing energy transition for prosperity.

If you would like to learn more about the Council's Trilemma Index, visit the latest tool and publication page at <https://www.worldenergy.org/publications/2018/trilemma-report-2018>.

The Council's Transition Toolkit User Guide provides ideas for using the Trilemma, Scenarios, and other Council Tools to support transition impacts.

Follow us on Twitter and LinkedIn to get the latest updates on the updated Trilemma that will be launched at the 24th World Energy Congress.



Trilemma scores for Energy Security and diversity of electricity generation (2018)

- Canada, the United States, Germany, Russia, the United Kingdom, and Italy have the highest Trilemma scores for diversity of power generation and these translate to the highest security scores.
- Energy exporters like Saudi Arabia, South Africa, Australia and Indonesia, have the lowest Trilemma scores for diversity of power generation.

While being a net exporter is an asset for energy security, none of these countries has a high security dimension score.

Managing energy equity through green transitions

Transitioning to renewable and lower carbon electricity generation while keeping electricity prices at affordable levels is a key challenge for G20 countries.

- Solar and wind power have significantly developed in the European Union to reach a 13% share of the electricity mix in 2016, up from 3% in 2006. This

Webinar on Existing Energy Infrastructure hosted by the World Energy Council

This webinar is part of the Innovation Forum series. Following-up on our "Energy Infrastructure: Affordability Enabler or Decarbonisation Constraint?" Insights Brief, this event convened experts from across our extensive network to discuss the brief's findings.

On July 22nd, the World Energy Council held a webinar presenting the results of its latest Innovation Insights Brief on existing energy infrastructure. Attendees had the opportunity to ask four key experts their questions on the topic:

- Michael Webber, Chief Science & Technology Officer, Engie
- Jacqueline Vaessen, General Manager, NexStep
- Hassen Bali, Co-founder, Ion Ventures
- Dave Hardie, Director of Liability, Alberta Energy Regulator
- The webinar started with a poll asking attendees where they saw the biggest repurposing opportunities for existing energy infrastructure — gas pipelines and oil fields for storage both received

45% of votes and offshore oil platforms 10%.

The questions ranged from repurposing opportunities companies are currently pursuing to the role of government and investors in this space.

The webinar ended with a second poll asking attendees whether they thought an energy infrastructure action plan is needed — 97% of the attendees responded that there is a need.

Key Highlights:

- Several repurposing asset opportunities exist for gas companies, including (i) replacing natural gas with green hydrogen (ii) using green hydrogen to produce green methane. Beyond the technical feasibility, the question is about cost: is it cheaper to replace the gas or to replace the infrastructure? The answer is not yet clear.
- An example of repurposing project in the Netherlands is Porthos, aiming at transporting and storing CO₂ in to the North Sea. The CO₂ collected from plants around Rotterdam will be transported via a pipeline network for

injection in depleted oil and gas fields in the North Sea. This is a CCS project that stakeholders are keen to follow and understand its cost effectiveness.

- Energy infrastructure investment strategies are slowly changing, and fossil fuel divestment movements are happening. For example, the London Stock Exchange recently updated its classification of oil and gas companies as "non-renewable" and changed the renewable classification from Alternative fuels to "Renewable energy". This highlights the growing investor pressure on fossil fuel firms to shift towards greener business models.
- The discussion around stranded assets goes beyond pipelines. For example, if power plants are shut down before the end of their useful lives, the income deficit this creates will have to borne by society.
- In general, successful energy transitions will require greater policy planning to take advantage of integration opportunities of new and existing energy infrastructure. For example, developing new renewables facilities close to the

gas grid could facilitate the injection of hydrogen, therefore prolonging existing assets. This requires cohesive and forward-looking policy.

• Speakers emphasised the importance of government intervention in developing appropriate prices on pollution. Today's lack of coherent carbon price around the world confuses capital allocation and energy infrastructure investment. Another challenge to forward-looking planning is policy volatility, i.e. policy which quickly changes from legislature to legislature. The session was recorded and is available on our YouTube channel. Watch it below, and don't forget to subscribe!

Next Steps:

- The Council will be working with individual countries and large incumbents to further the idea that an Energy Infrastructure Action Plan is not only a good idea, but a great business opportunity.

• Listen to the webinar in our YouTube channel: <https://youtu.be/9VtIpLJoRvA>



H.E. Dr Matar Hamed Al Neyadi

Photo: WORLD ENERGY CONGRESS

Far-reaching youth programme will inspire a new generation of energy leaders at 24th World Energy Congress

Some of the most important people attending the 24th World Energy Congress are not heads of state, business leaders or global investors — they are the young people from the Emirates and further afield who have travelled to the United Arab Emirates capital to participate in the Future Energy Leaders (FEL 100) programme.

Harnessing the power, ingenuity and creativity of the younger generation is a key goal for the UAE Organizing Committee of the 24th World Energy Congress.

While the foremost figures from the energy sector announce plans to develop a sustainable and diversified industry, it is the vitality, imagination and boldness of the youth taking part in the FEL 100 programme that will shape the future of the energy sector in the UAE and beyond.

The programme has welcomed young professionals and exceptional students to the World Energy Congress with the aim of involving them in national, regional and

internationally focused debates, activities and creative sessions to inspire them to grow into the new generation of energy leaders.

Held under the title 'Harnessing Youth's Energy' and sponsored by Emirates Nuclear Energy Corporation (ENEC), the FEL 100 programme includes a youth theatre and numerous 'activation zones' where young men and women will engage in a series of high-level discussions, networking events and workshops at the Abu Dhabi National Exhibition Centre.

These have been designed to stimulate discussion and create a meaningful dialogue on vital subjects related to energy production, supply, sustainability and diversification and much more.

A dedicated youth area has been created at ADNEC to draw together bright young minds for a series of 'Ignite Talks'.

These inspiring events will introduce youngsters to high-level ministers and industry leaders and spark a broad discussion that

addresses the need to promote clean sources of energy, skill development and leadership among other topics.

At its heart, the The FEL 100 programme is about encouraging creative debate and the sharing of new ideas to enhance each young participant's knowledge of the sector and inspire them to discover new and innovative solutions and ideas.

By inviting our most creative and inquisitive young minds to contribute to the search for solutions to the world's growing energy needs, the World Energy Congress is laying the foundations for a better future.

An inspirational collection of creative thinkers, the FEL 100 programme will allow youngsters to see first-hand the ways in which their talent can have an impact on the way the world uses, generates and shares energy tomorrow and for generations to come.

The programme is fully supported by the UAE's energy industry, with officials from DEWA, FEWA, Masdar among others as well as international companies and entities lending their

expertise and guidance to mentor and help talented youngsters.

The building blocks of a better, more sustainable, diversified and eco-friendly energy landscape are being laid in Abu Dhabi during the 24th World Energy Congress.

A talented, empowered and inspired youth are the perfect solution to the problems faced by the energy sector and the entire globe.

Today's world's energy leaders are gathered in Abu Dhabi and they are ready to pass on the baton to the leaders of tomorrow.

Over the course of the next four days these inspirational youngsters will prove that they are not only ready, willing and capable of rising to the challenges in front of them, but that they can overcome them and forge ahead to create a truly sustainable future for all.

H.E. Dr Matar Hamed Al Neyadi, Chairman of the UAE Organizing Committee for the 24th World Energy Congress and Undersecretary, UAE Ministry of Energy and Industry

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Industry future in spotlight

Adnoc chief highlights need for diverse energy mix

ABU Dhabi National Oil Company (Adnoc) chief executive Sultan Ahmed al-Jaber thinks \$11 trillion-worth of investments will be required for the global oil and gas sector to keep up with growing energy demand for the next two decades, writes Nishant Ugal.

Speaking at the World Energy Congress in Abu Dhabi, Jaber highlighted the need for a diverse energy mix but added that, in his view, oil and gas would dominate the energy mix for many more years.

He said that in the United Arab Emirates, “we have created an ecosystem that supports all forms of energy, from oil and gas to renewables and nuclear energy”.

“Having said that, we know that the world will still rely on oil and gas as the majority source of power for many decades to come,” he added.

Jaber said that “over three times the amount of energy currently consumed by all of Europe will be added to global energy demand in the next two decades”, which will require the integration of a fully diversified energy mix by oil companies.

Jaber said that Adnoc is on track with its production capacity expansion plans that target 4 million barrels per day of oil by 2020 and 5 million bpd by 2030.

Adnoc is understood to have embarked on several onshore and offshore developments worth billions of dollars, as it plans to increase its production capacity over the next decade.

In addition, Jaber said, Adnoc is “tapping into gas caps, undeveloped reservoirs and unconventional resources” as it aims to unlock vast reserves of natural gas.

Jaber said the world needs more energy with fewer greenhouse gas emissions and Adnoc would “continue to prioritise responsible production as it expands its operations”.

He argued that the company produces among the least carbon-intensive barrels in the world, with the lowest methane intensity.

Jaber said Adnoc is investing in technology that captures significant amounts of carbon dioxide from industrial sources and has laid down major expansion plans.

“We launched the region’s first commercial-scale carbon capture, utilisation and storage facility in 2016 and over the next decade we will expand this programme six times,” he added.

Jaber said that Masdar, Abu Dhabi’s green energy company, has invested in 4 gigawatts of renewable energy projects across the globe, which could go a long way towards bringing to fruition the emirate’s plans for energy diversification.

MIDDLE EAST



Centre stage: UAE Energy Minister Suhail al-Mazrouei at the World Energy Congress yesterday

Photo: AP/SCANPIX

UAE aims to reduce its carbon footprint by 70%

Energy Minister Suhail Mohammed al-Mazrouei tells World Energy Congress country is planning to **diversify its energy mix**

NISHANT UGAL

Abu Dhabi

THE United Arab Emirates is aiming to reduce its carbon footprint by as much as 70% by the middle of the century as the country also lays down long-term plans to diversify its domestic energy mix.

Energy Minister Suhail Mohammed al-Mazrouei, speaking at the World Energy Congress in Abu Dhabi, said the UAE would continue efforts to be a regular supplier of hydrocarbons despite the emissions reduction push.

“We would like to reduce our carbon footprint by 70% by 2050. We are encouraging all countries to diversify their energy mix to include cleaner forms of energy,” Mazrouei said.

He said the UAE has delivered the first long-term strategy in the region for promoting cleaner forms of energy. “We have a strat-

egy to share with the rest of the world. UAE’s strategy is calling for 50% contribution (by 2050) from clean forms of energy, which would include renewable and nuclear.”

The UAE’s long-term plans to diversify its energy mix and reduce greenhouse gas emissions are likely to lead to billions of dollars-worth of benefits to the emirate.

State-owned oil and gas giant Abu Dhabi National Oil Company (Adnoc) is aiming to reduce greenhouse gas emissions from its operations by 10% in another four years.

Adnoc has laid down plans to spend \$1.8 billion by 2023 in projects involving carbon capture, utilisation and storage; abatement of flaring; and reduction of unin-

tended emissions. The company earlier this year said that its emissions were less than half the industry average, and that it has one of the lowest methane intensities at 0.01%.

The UAE has laid out ambitious plans to boost clean energy and reduce dependence on gas-based power generation over the next three decades.

Awaidha Murshed al-Marar, chairman of Abu Dhabi’s Department of Energy, said at the World Energy Congress that the UAE is taking the “energy transition very seriously” and placing it at “the core of their programmes and strategies for the sector”.

Marar said nations stand at a crossroads — one that makes the transition to renewables and clean energy imperative in order to

achieve the United Nations Sustainable Development Goals and the tenets of the 2015 Paris Climate Agreement.

Marar added that the Abu Dhabi Energy Rationalisation Strategy 2030 “aims to reduce electricity consumption by 22% and water consumption by 32% by 2030”.

Abu Dhabi is also progressing a series of diversified energy projects including the Barakah nuclear power plant, the Noor Abu Dhabi solar photovoltaic plant and the Al Taweelah reverse osmosis desalination plant, he said.

The Barakah plant is being developed by the Emirates Nuclear Energy Corporation and is thought to be nearing completion, with local media reports suggesting that its construction is almost 93% complete.

MIDDLE EAST



Recommendations: IEA executive director Fatih Birol

Birol urges Middle East to div

International Energy Agency executive director tells **World Energy Congress** it is vital that region looks **beyond oil and gas**

ANAMARIA DEDULEASA

Abu Dhabi

INTERNATIONAL Energy Agency (IEA) executive director Fatih Birol has warned that it is “imperative” for the Middle East to diversify its economy away from oil and gas in the face of the changing global energy landscape and competition within the sector from the US.

“More than at any other point in history, this region needs to diversify its economy. It is very urgent now, imperative, because in this region 80% of the fiscal revenues come from oil, and a giant new producer has come up in the oil markets – the US, which has huge implications,” Birol told the World Energy Congress.

“Also, while oil demand will

increase, this increase will be weaker than what we have seen in the past because of the technological developments such as electric cars and improvements in energy efficiency,” he said.

“Much of the oil (volumes) that will be exported from this region may be at a lower level than before and also the price may be lower.

“My suggestion is that it is now time to broaden the economy.”

Birol’s recommendations come as the IEA’s figures show that investments in the energy sector in the past two years have shifted away from oil and gas to accommodate growth in the power sector. Birol said that in 2014 around

\$1.3 trillion of investments were made in the oil and gas sector and less than \$700 million was directed towards the power sector.

However, the market is now more balanced with 2018 investments in oil and gas down to around \$700 million, roughly flat with those in the power sector.

“The oil and gas segment of the energy sector has always seen the largest investments. However, in the past two years, the power sector has grown,” he said.

“This is because we see an increase in renewables but also we see the electrification of our societies and a push for digitalisa-

tion, all of which will continue to grow.”

The switch in the direction of investments comes as the global energy landscape is adapting to a changing world, focused on fighting climate change and working towards meeting the targets of the Paris Agreement by reducing emissions.

In this context, panellists at an afternoon session at the World Energy Congress, which also included Total chief executive Patrick Pouyanne and Eni chief executive Claudio Descalzi, said that while growth in renewable energy investments and capacity is welcome, it alone will not tackle climate change. If serious about

emissions, Birol said the oil and gas sector has to look at carbon capture and storage, nuclear energy and energy efficiency while also replacing coal with gas.

“Renewable energy generation is breaking records every year and yet emissions grow... we need to get all the technologies to work together to see results in fighting climate change and not pick a favourite and ignore the rest,” Birol said, referring to criticism that the latter move means replacing one fossil fuel with another instead of switching to a clean energy source.

However, he added the IEA’s data for the past five years suggest



Photo: BLOOMBERG

Diversify economies

that the switch from coal to gas has so far resulted in 500 million tonnes of emissions reductions.

Birol's view was supported by both Pouyanne and Descalzi, who said reducing emissions by replacing coal as an energy source with gas was part of their respective energy transition strategies.

Speaking on the same panel, Jean Pierre Clamadiou, chairman of French utility Engie said that amid a stronger focus on fighting climate change his company has had to adapt.

Engie last year sold its exploration and production business to private equity-backed Neptune Energy, and is now focused on

natural gas, electricity generation, energy efficiency and renewable energy.

"There is a need to go faster and address emissions, (therefore) companies need to speed up the transformation of existing systems into greener sources," Clamadiou said.

Francesco La Camera, director general of the Abu Dhabi-based International Renewable Energy Agency (IRENA) said the future energy mix will look different because oil would no longer be dominant.

"We need to reduce our footprint if we don't want catastrophic consequences," La Camera said.

More than at any other point in history, this region needs to diversify its economy.

IEA
executive director
Fatih Birol



Targets: Total chief executive Patrick Pouyanne

Photo: REUTERS/SCANPIX

Use of coal needs to end, says Pouyanne

PROVIDING the world with energy that is reliable, affordable and sustainable whilst meeting climate change initiatives and without killing the planet is not impossible but the use of coal needs to end, according to Total chief executive Patrick Pouyanne, writes Amanda Battersby.

Oil and gas will still be part of the global energy mix in 2040 or 2050 but burning coal should be a thing of the past, he said.

"The first part of our targets should be to eliminate coal, that's a primary target," Pouyanne told delegates at the 24th World Energy Congress, adding that investment last in coal last year was higher than it was annually from 2013 through 2016.

"[Secondly], we must stop deforestation of this planet... [the] natural-based solution of a carbon sink is the most effective one," he said.

Eni chief executive Claudio Descalzi also highlighted the impact of coal on the planet and the increasing drive to reduce global carbon dioxide emissions.

Coal currently accounts for around 38% of global power generation although its share of greenhouse gas emissions is considerably higher.

Descalzi agreed that the global future energy scene would indeed

be different despite the continuing use of fossil fuels.

"It is true that in 2040 or 2050 we'll still have 48% to 50% of oil and gas (in the energy mix) but the world is moving quickly in different areas" with varying and changing demand scenarios in OECD, non-OECD and developing countries, he said.

Pouyanne would not be drawn on predicting what future oil prices might be. However, he revealed the French supermajor's current portfolio includes projects that have a breakeven price of under \$25 per barrel.

"And we use an assumption, globally speaking, to approve investments [at an oil price of] around \$50."

Pouyanne noted that if the oil price does go higher then this would give Total more money to reinvest and he said this reinvestment would focus on the natural gas and liquefied natural gas, and power sectors.

"Natural gas is an abundant resource, it is a flexible resource and it is the right combination with renewables."

The World Energy Council forecasts that in 2040 renewable energy sources such as wind, hydro, solar and biomass will account for between 33% and 43% of global power generation.

Call for fossil fuel industry to adapt for greener future

THE fossil fuel industry must learn how to adapt and repurpose existing infrastructure as part of the transition to greener forms of energy, according to the World Energy Council.

"When we think about the energy transition, we need to think not about throwing out all the old infrastructure but how can we repurpose (infrastructure) and not produce a new supply chain," Christophe Frei, secretary general and chief executive told the World Energy Congress.

Frei pointed to a pilot scheme being undertaken in Japan whereby a small coal-fired power plant has been repurposed, telling delegates that such retrofitting could be applied at other plants around the world in an effort to cut carbon emissions in the power sector.

"They retrofitted this to ammonia," Frei said, adding the ammonia would be sourced from places such as Saudi Arabia and Australia, with contracts already in place.

"The beauty about ammonia is that it is the biggest traded chemical — you don't invent any new supply chain. What you invent is,

gradually you produce, greener and greener ammonia and deliver it into the existing supply chain," Frei said.

On the same panel, International Energy Agency secretary general Fatih Birol, pointed to coal in power generation as the biggest single problem when it comes to increasing emissions.

However, with coal-fired power plants in places such as India, Pakistan, Bangladesh and Thailand having a relatively low average age of 11 years, the likelihood of these countries turning their backs on coal as a source of energy in power generation any time soon is remote, Birol contended.

Alongside Birol and Frei, Eni chief executive Claudio Descalzi said action on lowering global carbon emissions is dependent on governments agreeing and implementing requisite policies.

"I am not very positive for the future," Descalzi said. "We talk a lot — we are really good talkers about what to do. Really it is a global issue, but we chose to treat it like a local issue."

He added: "(Even) with the best technology, if there is no policy, you cannot invest."

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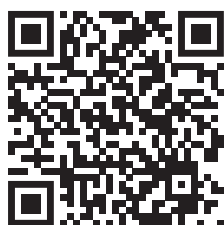
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TNS GALLUP



MIDDLE EAST

Saudi Energy Ministry to drop Aramco role

Prince Abdulaziz confirms department will step back from **state company's IPO drive**

NASSIR SHIRKHANI

Abu Dhabi

SAUDI Arabia's new Energy Minister Prince Abdulaziz bin Salman has confirmed that his ministry will separate its role from the running of Saudi Aramco as the state oil giant prepares for its initial public offering (IPO).

The ministry will, however, remain the main arbiter of Saudi oil policy and co-ordinate efforts with fellow Opec members and non-producers such as Russia to balance the oil market.

Abdulaziz, in his first public comments after being appointed last weekend to the energy minister role, appeared to indicate that Aramco will be given more leeway in defining its own priorities, including its upstream investment plans.

"I have no doubt in my mind that emphasising the separation between Aramco, the corporate, and the ministry as regulator is a must," he told delegates at the World Energy Congress in Abu Dhabi.

"The regulator cannot be a person, the regulator has to be an institution. That regulator role has to be defined, and the contours of the role of the regulator have to be understood," he added.

Up to until now the serving energy minister has dictated production goals and investment strategies at Aramco, while also acting as chairman at what is the world's largest oil company.

However, Aramco was given a chairman independent of the Energy Ministry last week after a reshuffle that saw then-Energy Minister Khalid al-Falih lose his role as chairman of a company, which is capable of producing 12 million barrels per day of oil.

Falih was then replaced at the weekend by Abdulaziz, who is the son of Saudi ruler King Salman.

It marks the first time a royal has been given the energy portfolio, which has usually been reserved for technocrats with long careers at Aramco.

The decision to separate Aramco from the Energy Ministry comes amid efforts to speed up a partial privatisation of the company, which generates most of the Saudi government's revenues.

Crown Prince Mohammed bin Salman sees the IPO as the pivot of his reform programme aimed at diversifying the economy to make it less dependent on crude exports.

Saudi Arabia is seeking to sell up to a 5% stake by 2020-2021, in



Appointment: Saudi Energy Minister Prince Abdulaziz bin Salman

Photo: AFP/SCANPIX

what could be the world's biggest IPO. It is still meeting banks pitching for roles on the deal, and is expected to appoint advisers in the coming days.

Meanwhile, Abdulaziz emphasised the importance of Saudi Arabia maintaining close links with Russia, which has played a crucial part in co-ordinating production curbs with Opec that aim to achieve higher oil prices.

Russian Energy Minister Alex-

ander Novak is planning to visit Riyadh to prepare for President Vladimir Putin's trip there that is scheduled for October.

"The climax of the visit will be signing so many agreements and really creating a stronger and more sustainable and much more comprehensive alliance with Russia," Abdulaziz said.

"We're talking about a sustainable, perpetual alliance. We will discuss so many things, including

our bilateral relationship," he added. Ties between Saudi Arabia and Russia have developed since 2016 after the producer group and a number of non-member countries formed the Opec+ alliance.

Abdulaziz also said his new role will continue with the long-established tradition of consensus building within Opec that brings together a diverse group of producers often with competing political agendas.

First gas exports at Touat

ALGERIAN state oil and gas company Sonatrach and partners Neptune Energy and Engie have started gas exports from the Touat gas development in the country's remote south-west.

Touat, around 1400 kilometres from the capital Algiers, will deliver around 75,000 barrels of oil equivalent per day of gross production at plateau.

The development comprises 19 development wells, a gas treatment plant for gas and stabilised condensate with a gathering network and export pipelines.

Although the maiden exports have just been announced, first gas entered the Touat facilities in February.

Production from Touat, which is set to last more than 20 years, will represent about 6% of Algeria's total gas exports.

The project has involved the installation of a connection to the main GR5 pipeline, built by Sonatrach, to collect the gas from south-west Algeria and bring it to Hassi R'Mel, about 800 kilometres to the north.

Philip Lafeber, Neptune's vice president for North Africa and Asia Pacific, said that, with phase one of the project complete, the company will now look to implement phase two, which covers the remaining eight fields to help maintain plateau production at 450 million cubic feet per day for many years to come.

Dorian spill clean-up

NORWAY'S Equinor has mobilised equipment and personnel to tackle an oil spill at its South Riding Point crude storage and transshipment terminal in the Bahamas, amid onshore devastation left in the wake of Hurricane Dorian.

The spill, covering about 650 square metres inland, was caused after tanks at the terminal on Grand Bahama island suffered damage when the hurricane made landfall last week, affecting 54 employees with Equinor who are all accounted for and unharmed.

The terminal has 10 tanks with total storage capacity of 6.75 million barrels of crude and condensate.

Some 1.8 million barrels were being stored in three of the tanks when the hurricane hit, with the others containing only residual oil.

The roofs of five of the tanks were ripped off by the force of the hurricane.

A vessel carrying emergency relief including water and food for the Equinor workers has arrived on the island, with another two vessels now en route from Louisiana, US with 43 oil spill response personnel and clean-up equipment, according to the company.

Industry climate concerns

A World Energy Congress panel on Monday sought to address the issue of what impact climate concerns would have on the future role of hydrocarbons.

Panel moderator Leonhard Birnbaum, a board member of German utility E.ON, sparked a lively discussion by asking the audience to predict future levels of international coordination over climate change, with a resoundingly pessimistic response.

India's Minister for Power, Subhash Chandra Garg, admitted solutions to the challenge are still being sought by a nation that has a growing population and continued reliance on coal-fired power.

"Coal will continue to be a major source of power but we are looking at ways to develop renewables, such as incentives for electric cars, and taking advantage of cheaper (battery) storage solutions. We are confident that we can cover our future growth with renewables," he said.

Fatima Alfoora Alshamsi, Assistant Undersecretary for Electricity, Water & Future Energy at the United Arab Emirates' Ministry of Energy & Industry, outlined the UAE's plans for developing alternative sources of energy and decarbonise its economy.

Yet Alshamsi also acknowledged the country's consumption of natural gas would continue to increase due to overall economic growth and despite the plan for clean energy to account for 50% of the country's energy mix.

More support for the continuing importance of hydrocarbons was provided by Rafael Chaves Santos, chief strategy officer at Brazilian oil company Petrobras.

"We all agree that oil will be replaced in time and that the markets are good at anticipating disruptive events but just watch the oil auctions that will take place in Brazil later this year and you will see how much interest there still is among players attracted to the prospect of extracting oil for \$6 or \$7 per barrel," he said.

Jules Kortenhorst, chief executive of the pro-sustainability entity Rocky Mountain Institute (RMI), disagreed with the other panellists, arguing demand for oil would start dropping before the end of the next decade.

Kortenhorst cited a new RMI report that claims 90% of new thermoelectric power stations in the US are unprofitable against competition from renewable energy.

Kortenhorst also argued that improving battery storage will make electric cars more competitive in the next four or five years, aligning consumers with higher policy objectives.

MIDDLE EAST



From left: IHS Markit vice chairman Daniel Yergin, UAE Energy Minister Suhail Mohammed al-Mazrouei, US Department of Energy Deputy Secretary Dan Brouillette and Bahrain Oil Minister Mohamed al-Khalifa at the World Energy Congress opening ceremony
Photo: AFP/SCANPIX

Energy transition takes Middle East centre stage

World Energy Congress panel offers insight into efforts driving changes in **global industry**

GARETH CHETWYND

Abu Dhabi

A discussion panel on the opening day of the World Energy Congress offered insight into the way Middle East states are responding to the challenges of energy transition, while considering the role that the US has played in driving change in the global energy sector.

The panel on the outlook for hydrocarbon economies was moderated by Daniel Yergin, vice chairman of energy consultancy IHS Markit and author of oil industry classic *The Prize*.

United Arab Emirates Energy Minister Suhail Mohammed al-Mazrouei recalled some initial worries when US shale production began affecting global energy supply.

Mazrouei acknowledged that Opec's own restraint on supply likely provided the price support that helped shale build its early momentum.

However, he also accepted that the US excelled in reducing the

cost of finding and producing unconventional oil.

"There is still healthy demand for hydrocarbons, and you have to wonder what the world would be like today without shale (oil and gas). It is hard to see how we would have replaced reserves on this scale," Mazrouei said.

These advances have also opened the way for other companies to develop their own potential for producing shale oil and gas.

Bahrain's Oil Minister Mohamed al-Khalifa said his country has been making strides in understanding the potential for producing from shale located in shallow waters.

"This is still quite recent and it has not been tested as the Permian basin (has), but we are talking about the richest source rock in the world," he said.

US Department of Energy Deputy Secretary Dan Brouillette noted that the turnaround in

energy security afforded by unconventional production was largely driven by knowledge and innovation, with regulatory changes playing a secondary role.

"The benefits of this can be seen with the creation of between 10 million and 11 million jobs before you take into account the factories that open in response to the availability of a stable and secure supply of energy," he said.

With future production forecasts ranging from 7 million to as much as 16 million barrels per day, Brouillette said the US will need to see a proliferation of pipeline infrastructure and export facilities, hinting that this may create a need to address regional differences in regulatory controls.

In his own diagnosis of the US shale boom, Khalifa said central bank policies on quantitative easing and cheap access to the dollar had played a key role in attracting investment despite low oil prices and the risks involved in develop-

ing fracking technology. "Oil is the second most important commodity, behind the dollar," he said.

The Bahrain minister predicted, however, that shale output would not enjoy a breakeven point much below \$60 and said that the recent reinforcing of Opec alongside non-members such as Russia would be important as oil supply begins to weaken in the face of steady demand.

"This will keep us together for a very long time," he said of the agreement, signed in June.

On energy diversification Mazrouei outlined the UAE's "bold strategy" to attain a 50% role for clean forms of energy to the country's own energy mix by 2050.

The transition will use offtake agreements to allow cleaner sources of energy to gain a foothold, and will be driven initially by nuclear power, but will become increasingly focused on renewables, he said.

MIDDLE EAST

NPCC teams up with China duo

Abu Dhabi-based contractor signs MoUs with **China Petroleum Engineering & Construction Corporation** and **China National Chemical Engineering Corporation**

NISHANT UGAL
Abu Dhabi

ABU Dhabi-based offshore fabrication player National Petroleum Construction Company (NPCC) has signed agreements with China Petroleum Engineering & Construction Corporation (CPECC) and China National Chemical Engineering Corporation (CNCEC) to co-operate on onshore and offshore oil and gas projects.

NPCC on Monday signed memoranda of understanding with the two Chinese companies on the sidelines of the World Energy Congress in Abu Dhabi.

The MoUs are aimed at “joint collaborative opportunities in both onshore and offshore oil and gas sectors, as well as other strategic areas of interest”, NPCC said.

NPCC, which is Abu Dhabi’s largest offshore engineering, procurement and construction contractor, is hoping to expand its presence in the onshore EPC sector in collaboration with CPECC, industry sources suggested.

Abu Dhabi National Oil Company (Adnoc) is progressing its \$10 billion-plus Hail & Ghasha and Dalma sour gas development projects and one source suggested that NPCC could consider bidding in these ongoing tenders along with the Chinese companies.

NPCC said that, as per its agreement with CPECC, it “will explore potential opportunities to co-operate on projects that will create value for both companies”.

The MoU with CNCEC is aimed at co-operating on Adnoc projects and exploring “opportunities for financing services” on Abu Dhabi-based projects, NPCC added.

Chairman Mohamed Rashed Al Hameli said the two agreements “will further drive the global ambition of NPCC to become one of the largest providers of EPC solutions for the energy sector”.

Al Hameli added that the MoUs would also help the company to expand its footprint in China, which is thought to be one of the largest growth markets for the energy sector.

CPECC in 2017 landed a substantial onshore EPC contract from Adnoc covering expansion work at the giant Bab field in Abu Dhabi.

The onshore contract was understood to be valued at between \$1.7 billion to \$1.8 billion.

NPCC is a joint venture between Senaat, an Abu Dhabi government holding company, and Consolidated Contractors International Company (CCIC), with Senaat holding 70% and CCIC the remaining 30%.



Solutions:
NPCC
chairman
Mohamed
Rashed Al
Hameli

Photo:
NPCC



SONATRACH, Involved in the Energy Transition



The Energy to **Drive Change**

US shale growth doubts

US shale output growth is “unlikely” to continue at the same impressive rate as seen in the previous few years, with the influx of majors to in particular the Permian basin bringing with it a new financial reality, according to L1 Energy chairman John Browne.

Although growth in Permian tight oil production has been “a remarkable revolution”, that “growth rate is unlikely to be maintained” in the year ahead, the former BP chief executive said at the World Energy Congress in Abu Dhabi.

The US unconventional market was opened up by smaller “clever, entrepreneurial companies” that were fuelled by debt and the ability to continue to tap equity markets.

“That is changing and it is much more in the hands of the bigger companies now,” Browne said.

“It is part and parcel of the supermajor planning approach, which means there will be a certain amount of capital going in and not a penny more, and in the end it has to produce cash flow. That wasn’t the case with smaller companies.”

Browne added: “That is undergoing a big change. I would expect, therefore, the rate of change to be moderated significantly.”

Current tight oil output in the US is around 9 million barrels per day, with takeaway capacity constraints in key plays such as the Permian basin in Texas and New Mexico one factor in limiting production.

Output is predicted to grow, with some projecting 20 million bpd or more in the years ahead. Jarand Rystad, chief executive of Norwegian consultancy Rystad Energy, recently said that tight oil production could hit 25 million bpd in a little over a decade.

Permian and the Delaware sub-basin will remain central to US tight oil production, while the Midland, Eagle Ford, Bakken and Haynesville are other key basins.

Browne himself would not be drawn on where US shale output will land in the years ahead, cautioning: “Who knows, is the answer.”

“There are plenty of things that will move positively and negatively in the US.”



On location: a pumpjack in the Permian basin

Photo: NOAH BRENNER

INDUSTRY OUTLOOK



L1 Energy chairman John Browne at the World Energy Congress

Photo: EOIN O'CONNIDE

Browne urges industry to control carbon emissions

L1 Energy chairman and former BP chief executive tells World Energy Congress that carbon tax is key to helping **counter global warming**

EOIN O'CONNIDE
Abu Dhabi

THE world needs to control carbon dioxide emissions now if it wants to avoid the need for massive global infrastructure adaptation at a later date, according to former BP chief executive John Browne, who also argued that a carbon tax is key to efforts to curb temperature rises.

The current chairman of private investment company L1 Energy is also preparing for a lower-growth future for the global economy and sees existing technology solutions as adequate to combat climate change, if harnessed correctly.

While at BP, Browne was one of the early advocates of an energy transition, helping to brand the ‘Beyond Petroleum’ image of the UK supermajor embracing alternative forms of energy to fossil fuels.

“It was very clear in 1997 — there was enough information, enough facts, enough analysis — saying carbon dioxide was changing the way the climate would work and we were producing carbon dioxide and methane, which was just as damaging,” Browne

said on the opening morning of the World Energy Congress in Abu Dhabi.

“We couldn’t determine what the world would do, so... we had a very specific set of actions — an action plan,” he said.

“So, we did that and we hoped that others would follow. There were one or two other people who said ‘Yes, we are going to do something.’

“But the vast bulk of people said ‘Why don’t we kick this can down the road and wait and see.’ And I think that’s really what happened for the next 20 years or so.”

Browne said the industry and world at large has “wasted a quarter of a century doing little” but added that the intervening period has seen the development of technologies that can alleviate the effects of global warming.

“We don’t need to innovate anything, we actually need to deploy technologies that we have today and then we can begin to cut this problem down to size,” he said.

A continued switch from oil to natural gas is part of the solution

but more measures are required to meet the goals of the Paris Climate Agreement of keeping temperature rises to a minimum.

“I think the change will be slow and, therefore, the technologies you need to keep temperatures down are heavily linked to the capture, storage or use of carbon,” Browne said.

The long-time industry executive also sees carbon pricing as “the key lever” in combating emissions growth.

“There needs to be enough incentive for people to want to do something with CO₂, so a carbon tax is, in my view, the way to go,” he said.

However, if efforts to prevent or reduce CO₂ emissions are not stepped up, “I think we will have to do significant infrastructure adaptation”, Browne added.

This would require massive investment, he said, adding: “I think the balance (of investment in the energy sector) will continue to shift, and it should be shifted by lenders who should bias their approach to lending

to lower-carbon sources of energy.”

L1 Energy, which is controlled by Russian billionaire Mikhail Fridman, is a significant investor in fossil fuels, but Browne said he is “certainly planning for much lower growth” in the global economy.

“It certainly feels like we have come to the end of the big expansion period that we have had... I think we are going to be in a low-growth period for some time until something happens,” he said.

“I hope every decade we will see a measurable change. But remember, this transition is about changing the infrastructure of the world and changing the political economy of the world... this is not like updating your iPhone,” Browne said.

“I think transitions are very long, and they may never in the end reach any destination.”

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DP World marine logistics in Dubai.

P&O – An enduring legacy of global maritime excellence

With a vision to achieve global maritime excellence, P&O; a prominent DP World Group brand enjoys a long and proud history spanning over 180 years of delivering exceptional marine services to the international energy industry, commercial clients and governments around the world.

P&O currently operates four core business streams which include: oil and gas, ports, government marine and cargo marine that complement each other through the sharing of resources, assets and innovative solutions that ensure operational synergies and best in-class service delivery.

With the ability to seamlessly cross between our fields of specialization in markets where we are present, we can readily provide our clients with integrated added-value services across all aspects of our core business streams.

Be it in harsh environments or remote corners of the earth, P&O has firmly established itself as a trusted and reliable operator able to quickly localise its services and effectively support local communities and employment with over 2,000 people and a fleet of over 300 vessels. This includes anchor handlers, harbour tugs, pilot boats, mooring boats, pusher tugs, research vessels, self-discharging bulkers and general-purpose supply vessels.

In line with DP World's business strategy, P&O enjoys a long-term contracting model that is flexible with consistent rebid success once it achieves investment parameters with offerings ranging from low-risk ship management to full commercial risk acceptance.

P&O's growth strategy has evolved to focus on the expansion of core business streams with a broad range of vessels and solutions that are individually tailored for rapidly-evolving customer needs and expectations. Our approach to long-term relationships and our diverse services have been key to absorb the global slowdown in shipping linked to sluggish international oil prices in the last four to five years.

Despite the instability in global oil and gas markets, and the decreased levels of exploration and development, the global demand for energy is now rising significantly and is expected to grow by 12% by 2025, primarily due to forecasted population growth,

a substantial increase in GDP per capita, and a growing middle class in non-OECD countries.

Through sustainable partnerships, and our mission to deliver maritime solutions through close collaboration and engagement, P&O has demonstrated its ability to assess fast-changing trends and develop impactful solutions to the highest industry standards.

As a key player in the energy sector, our port marine services division complements our oil and gas services through the deployment of similar vessels and knowledge exchange to effectively support customers. Key services include harbour towage, berthing/unberthing vessels, mooring, surveillance, nav-aid maintenance, crew transfer, pilotage, and firefighting and environmental services such as pollution control achieved through the deployment of expert personnel and suitable assets.

Spanning six continents, our global footprint in the energy sector currently provides leading solutions to nine countries including the UAE, Canada, Norway, Spain, Equatorial Guinea, Papua New Guinea and Trinidad and Tobago.

As for the public sector, the government services division of P&O currently provides services in the UK, Ireland and Australia. This business has included defence and customs support in the past but currently focuses on the marine science and resupply area. The vessels deployed in these nations have specialist capabilities beyond standard vessels to achieve scientific aims and are utilised globally including in the Antarctic.

Our port marine services deliver unmatched support on a daily basis to customers in Dubai, Maputo, Limassol and multiple Spanish ports. Our cargo service business includes river barging operations in South America and PNG as well as self-discharging bulk vessels in Australia.

Leveraged by DP World's role as a global trade enabler, P&O has established itself as an industry pioneer across a broad spectrum of maritime supply chain solutions through ongoing improvement, operational versatility and the adoption of technology as a catalyst for smarter trade.

A recent example of our commitment to innovation is the partial de-

sign of our South American cargo fleet which was specifically created to deal with low river levels in remote areas of the continent. In addition, we were responsible for the design of the ice-class vessel 'Aurora Australis' for the Australian government to cover their Antarctic expeditions for over 20 years.

In terms of our work in the renewable energy space, P&O designed crew transfer vessels for the market on a first mover basis. These vessels disrupted the sector by offering improved speed, fuel efficiency and safety, setting new precedence and market standards.

With organic growth at the helm of our expansion strategy, P&O has diversified significantly since 2012 complemented by the acquisition of majority shareholdings in Remolcadores de Puerto y Altura S.A. (P&O Repasa), the Spanish operator of offshore support vessels for the energy industry. The P&O JV became well-positioned to leverage the combined strengths of the two entities through wider reach in the global LNG market, which is expected to double in size in the coming years.

Another driver for growth was the acquisition of P&O Reyser (Remolques y Servicios Maritimos, S.L.), another Spanish company providing maritime services internationally since the 1960s. P&O benefited from Reyser's long-term agreements in 10 Spanish ports and contracts with two international LNG terminals at Saint John, New Brunswick in Canada and Point Fortin in Trinidad and Tobago.

In recent years, P&O has moved from a regional delivery model to a centralized model which oversees local business units worldwide. This has resulted in cost efficiency and service optimisation paving the way for additional business in the company's marine services portfolio.

Moreover, the LNG sector has been an important space for P&O as the Group has, in a short span of time, been successful in the revision, evaluation, design and implementation of solutions for clients. This includes reviews of client LNG infrastructure, local environment analysis and the proposition of specific and achievable solutions for the LNG sector such as the Sonker LNG terminal in Egypt.

This geographical footprint as well as our product offering, and broader capabilities have been key drivers for P&O and DP World's diversification strategy which aims to lead the future of world trade by creating new opportunities for investors and removing inefficiencies in the supply chain.

Furthermore, P&O's role in serving the complex and rapidly evolving needs of the maritime energy sector is currently undergoing a notable expansion through DP World's July 2019 acquisition of Topaz Energy and Marine for \$1.1 billion. The deal is considered

a critical strategic investment and a notable move towards the energy sector demonstrating DP World's global status as an end-to-end logistics solutions provider.

The transaction, which will be closed shortly, adds substantial scale and complements the operations of P&O's marine services business, cementing its position as a leading operator in energy logistics.

Topaz has been a leading provider of critical marine logistics and solutions to the global energy offshore industry for the last three decades, operating a modern fleet of 118 vessels, predominantly in the Caspian, MENA, and West Africa regions. Topaz also brings high quality crews recognized for their sense of craftsmanship and a strong HSE track record; a fundamental area for P&O and the broader DP World Group.

Moreover, P&O, leveraged by the Topaz acquisition, will undergo the rethinking of offshore logistics for key oilfields, such as the construction and design of Module Carrying Vessels (MCVs) to transport modular units to Kazakhstan for installation at a megaproject in the Tengiz field – the sixth-largest oil field in the world.

As part of DP World's creation of synergies across its maritime services, P&O also operates drydocks operations through world-class shipyard services based in Dubai, offering services for the fabrication of offshore oil and gas and renewable energy projects, ship repair and conversion and ship building.

Driven by more than three decades of experience, P&O's Drydocks arm offers trusted services to the energy sector and vessel owners alike. The business leverages the expertise and resources available in its Dubai hub to provide global support services to clients through its Global Offshore Division (G.O.S.). The business constantly evaluates processes and equipment in line with industry best practices, to ensure it remains competitive and attractive to its client base.

The yard, which spans 429 hectares with 3 graving docks (capacity up to 350,000 dwt), a floating dock (40,000 dwt capacity) and a hydro lift is equipped with multiple cranes, berthing wharfs, storage facilities and capacity to provide services in all aspects of vessel and offshore production and construction activities. To date, P&O has successfully completed more than 8,500 ship repair projects, 170 rig repairs, 33 vessel conversions and 91 offshore.

With approximately 9,000 employees, a globally strategic location in the heart of the Gulf and state-of-the-art facilities, the drydocks business of P&O provides a value proposition to its client base that is second to none in the region.



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