FIFTH IEF-KAPSARC THOUGHT LEADERS' ROUNDTABLE

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A SUSTAINABLE AND COMPETITIVE ENERGY SUPPLY THE ROLE OF EFFICIENCY AND INNOVATION

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Background

Global energy security is built on the interactions between the cyclical development of supply and demand fundamentals, and the evolution of policy, technology, and foreign economic and security relations. National market, and foreign economic and security considerations have shaped energy security throughout most of the 20th century. The establishment of the International Energy Forum (IEF) marks the turning point. Shared producer and consumer interests in oil and gas market stability and access to reliable data for well-informed policy and investment decisions have characterised dialogue on energy security and market outlooks in the globalised world of the 21st century. The IEF provides a unique and neutral platform to strengthen energy security through data-driven dialogue amongst producers and consumers on market, policy, and technology evolutions, enhancing energy market transparency and foresight in an informal partnership with interdependent stakeholders.

This roundtable will focus on the opportunities for enhancing efficiency in the oil and gas value chain, the technological options available, the economic viability of such methods, investments needed, and finally, the impact on demand and supply.

Introduction

The cyclical nature of oil and gas markets, combined with advancing energy sector transformation has increased energy market volatility, creating barriers for investment in new projects while demand for hydrocarbons continues to grow. Given the changing dynamic of energy markets, government and industry are compelled to sharpen focus on enhancing energy efficiency and innovation in order to make energy supplies more competitive and sustainable in the long-term.

Alongside the rise of renewable energy technologies, major energy projections forecast that hydrocarbons, particularly oil and gas, continue to contribute a majority share of global primary energy demand well beyond 2040. In main outlook scenarios, fuel shares remain relatively unchanged when compared to alternative scenarios that advance the transition to alternative energy sources. In the spirit of embracing energy transitions and the ascent of renewable technologies in the long-term, policies must shift focus to the application of new technologies in order to achieve greater efficiency through innovation in hydrocarbon supply chains.

In the short-term, though awareness and acceptance of climate change and environment-related public health issues has grown, hydrocarbon-based energy demand has remained surprisingly resilient amid the falling cost of renewable energy. Demand for hydrocarbon power generation in Asia continues to expand, even excluding major consumer economies like China and India. Indonesia plans to establish over 50 gigawatts (GW) of hydrocarbon-based power generation

and Vietnam almost 40 GW between 2016 and 2025. In Europe, new oil fields continue to be discovered in the North Sea despite development challenges in the region. As the need for reliable, dispatchable power remains, so does the demand for hydrocarbons.

While managing the competing demands of emission-related regulations, complex cost structures and the growing for need higher-returns to offset uncertainties related to both investment hurdles and public acceptance, the hydrocarbon industry must rise to the challenges of future demand scenarios.

Workshop Themes

- **Efficiency Drivers and Gains in Hydrocarbon Supply Chains**

  What are the economic imperatives and constraints that energy markets face today? How will efficiency gains impact the way the oil and gas industry will operate in future?

- **Integrating Low-Carbon Energy Technologies in the Upstream and Mid-Stream**

  Which parts of the value chain can be less carbon intensive and therefore cleaner, allowing the sector to operate in a more sustainable manner?

- **Innovation in Energy Systems**

  The role of new technologies to remove and or make use of carbon in the value chain. How does policy intervention help innovation and deployment?

- **The Evolution of the Oil and Gas Business Model**

  What impact will investments in efficiency and innovation have on the competitiveness of the oil and gas sector and the evolution of oil and gas business models?

Opportunities

The drive toward energy efficiency is fuelled by technological developments in the upstream sector, such as through Enhanced Oil Recovery (EOR), Carbon Capture and Storage (CCS) or Carbon Capture Utilization and Storage (CCUS), where technologies can be implemented to reuse unwanted emissions or reduce these for instance through use of renewable energy technologies. This includes the prospect of creating innovative energy sources to make liquids and using that for clean power generation or as a transportation fuel in future. The adoption of these technologies will allow the industry to provide affordable, clean, and high energy-density hydrocarbons and remain competitive under evolving market and policy conditions. As governments anchor long-term energy policy to higher environmental and health standards, new windows of opportunity open to innovate and deploy new technologies profitably.

Cost-Structure Responsiveness

Unconventional oil and gas has gained notoriety over the last ten years due to its enormous success in the US. Despite slow progress in China, and contentiousness in Europe due to both public acceptance and geological realities, unconventional oil and gas reveals that geology and technology are only part of the story. Policy and cost-structure responsiveness remain important factors when considering the development of unconventional and alternative resources.

Historically, unconventional resources have been more expensive to produce. The shale boom that propelled the US to become a major crude producer has been anything but linear. The US shale industry is comprised of a multitude of diverse actors with access to sophisticated financial and technology markets, giving them the ability to manage risk, innovate and adjust investment schedules according to cost-price fluctuations. This responsiveness is a result of the open market structure which gives US unconventional oil and gas producers a competitive edge over other state players, allowing unconventional production outside the US to remain nascent.

Nevertheless, the lesson of cost-responsiveness has been picked up by international oil companies (IOCs), which now seek lower break-even prices and more short-cycle projects that allow for a more flexible investment funnel.

Digital Technology

Of all the disruptive technologies to emerge in the last decade, digitalisation, the proliferation of data, improvements in real-time data analytics, and artificial intelligence that can gather, analyse and adapt to shifting data-trends have had the most profound consequences for large portions of the global economy. By contrast, these technologies have yet to reach their full potential in the hydrocarbon industry.

The industry has announced multimillion-dollar investments in digital technology initiatives. Improved automation systems, better data analysis to drive predictive monitoring systems, enhanced risk management systems based on self-learning algorithms all have the potential to reduce environmental impact, boost economic returns and secure stable investments of current energy technologies.

The incorporation of such technologies could unleash billions of dollars' worth of additional value, reduce emissions and help prevent spills. This is an apparent win-win for the industry, but still requires significant changes to traditional business models that may be difficult to implement.

Reorienting Environmental Constraints as Economic Opportunities

The share of gas in global primary energy consumption has grown consistently over the last fifty

years. What was once a waste product flared by the industry has become a valuable energy resource. Today, as regulations on flaring have tightened, new commercial opportunities have been sought and found to transform the way we deal with energy emmissions.

Methane leaks are an environmental concern and also a drain on profitability. Opportunities exist to turn in-transit liquefied natural gas (LNG) 'boil off' into a usable resource, through re-liquefaction or dual-fuel engines that can use it to power ships. New ventures into capitalizing on bi-products of oil and gas production can be reoriented to lead to economic opportunities for producers. This is evermore important as International Maritime Organization's rules on sulphur emission reductions enter into effect in 2020. Carbon dioxide (CO_2) that might once have been vented or even prevented gas production can now be used through enhanced oil recovery techniques to extract more gas[1].

Decarbonisation Through Innovation

Hydrogen continues to become part of a low-emission energy mix. Japan published its Basic Hydrogen Strategy on 27 December 2017 to pioneer the first "Hydrogen Society" where it has dedicated $1.5 billion towards technology research and development[2]. Japan collaborates with fossil fuel producers to develop hydrogen from fossil fuels with CCUS technology, providing a zero-carbon resource. Alternatively, Norway has pioneered the implementation of electrolysis technology to produce hydrogen using natural gas reforming. Since the implementation of Norway's National Hydrogen Strategy several other nations have invested in hydrogen projects[3].

Hydrogen can be safely produced and transported from fossil fuels (coal, natural gas, and oil) through steam reforming. Hydrogen can also be produced through electrolysis though steam reform is most cost-efficient. In addition, hydrogen can be transported by the same pipelines which transport natural gas as well as via hydrogen tanks. However, the long-distance transportation of hydrogen remains a challenge, though liquefaction or conversion to hydrogen-rich compounds like ammonia offer potential solutions. Refueling stations also continue to be a challenge as they can cost up to five times what a conventional gasoline stations cost. With a view to a more environmentally friendly energy future, Japan plans to set-up a fund of $328 million to develop 27 additional hydrogen fueling stations in Tokyo by 2020. Norway, which utilises hydrogen on a large scale in the industrial sector, is currently working with the private sector and government to enlarge the vision of the HyNor Project and expand hydrogen use to public refueling. Norway has pioneered the transition to a hydrogen-based economy which already generates hydrogen power for commercial and private building use such as heating and cooling.

As environmental regulations evolve and change the energy industry's cost structure, new

[1] World Resources Institute. (2016). Upstream Emissions as a Percentage of Overall Lifecycle Emissions.
[2] IFRI Centre for Energy, Japan's Hydrogen Strategy and its economic and geopolitical implication. Monica Nagashima Oct 2018 nor.
[3] Norwegian Hydrogen Forum, The Norwegian Hydrogen Guide.

challenges and opportunities will continue to arise. As with cost-structure responsiveness and the incorporation of new technologies, sustainable competitiveness will likely stem from flexibility. This includes commercial, technological, intellectural and cultural flexibility to respond to change as energy markets and long-term policies remain dynamic.

Ongoing Dialogue

Dialogue on competition and sustainability is part of an ongoing conversation that government and industry must have in order to stay ahead of competition, comply with new and existing regulations, and continue to turn challenges into opportunities in preparation for an emmission constrained future. Long-term policy makers must focus on progress in the value chain, the drivers of energy efficiency and innovation, technological advancements and value propositions in line with national and international commitments for a sustainable energy future.

The Fifth IEF-KAPSARC Thought Leaders' Roundtable follows up on the encouragement by IEF Ministers to pool efforts in globally integrated frameworks to accelerate energy efficiency gains across the full energy sector spectrum and leverage the IEF Energy Efficiency Knowledge Sharing Framework, in collaboration with relevant organisations, and governance platforms to gain a better understanding of the role of energy efficiency and innovation in global sustainable and competitive energy supply.

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