



Joint IEA-IEF-OPEC Report

On the

Ninth Symposium on Energy Outlooks

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Riyadh | Saudi Arabia

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1. Introduction

This summary reflects the main outcomes of the Ninth session of the IEA-IEF-OPEC Symposium on Energy Outlooks that the International Energy Forum (IEF) convenes yearly, in collaboration with the International Energy Agency (IEA), and the Organization of the Petroleum Exporting Countries (OPEC). The symposium was held on 27 February 2019 at the IEF Headquarters in Riyadh and convened more than 150 participants from industry, government and academia. This included ministers and other high-level industry and government representatives who gathered alongside world-renowned experts with a diverse range of backgrounds.

HE Khalid Al-Falih, Minister of Energy, Industry, and Mineral Resources, Saudi Arabia made introductory remarks on behalf of the host country of the IEF, alongside HE Shaikh Mohammed bin Khalifa Al Khalifa, Minister of Oil of Bahrain and HE Manuel Quevedo, People's Minister of Petroleum of Venezuela and President of the OPEC Conference.

The Symposium was opened by HE Dr Sun Xiansheng, Secretary General of the IEF, HE Mohammad Sanusi Barkindo, Secretary General of the Organization of the Petroleum Exporting Countries, and Mr Keisuke Sadamori, Director, Energy Markets and Security, representing the Executive Director of the International Energy Agency. On behalf of the three organisations, this year's Symposium also welcomed as special guests HE Yury Sentyurin, Secretary General of the Gas Exporting Countries Forum (GECF) and Mr Ian Mead, Deputy Administrator of the U.S. Energy Information Administration (U.S. EIA). Discussions focussed on the IEA and OPEC flagship outlook publications informed by the comparative analysis of insights on energy demand and supply trends in the Introductory Paper prepared by the IEF and Resources for the Future, in consultation with the IEA and OPEC.

HE Dr Sun Xiansheng, Secretary General of the IEF, Mr Adam Sieminski, President of

the King Abdullah Petroleum Studies and Research Centre (KAPSARC), and Dr Adnan Shihab-Eldin, Director General, Kuwait Foundation for the Advancement of Sciences (KFAS) moderated discussions that were held under the Chatham House Rule and structured in three sessions on:

1. The Latest IEA and OPEC Projections and Key Findings from the Comparative Analysis conducted by the IEF in collaboration with Resources for the Future.
2. Key Stakeholder and Industry Views on Short-, Medium-, and Long-Term Energy Outlooks featuring a keynote address by the GECF, and
3. Investment and Challenges in the Petrochemical and Refining Sectors introduced by a keynote address by the U.S. EIA.

The Joint Symposium on Energy Outlooks is one of three joint high-level expert meetings that the IEA, IEF and OPEC undertake under the trilateral work programme of the producer-consumer dialogue to enhance the understanding of energy market and policy developments. The trilateral work programme was agreed upon by the three organisations under the Cancún Declaration, which was endorsed by energy ministers at the 12th IEF Ministerial Meeting, held in Cancun, Mexico, in March 2010, as referenced in Attachment Two of the Cancún Declaration. In addition to the Joint IEA-IEF-OPEC Symposia on Energy Outlooks, the trilateral collaboration involves workshops on Physical and Financial Energy Market Interactions and Gas and Coal Market Outlooks.

Substantial progress was made over the course of the previous eight IEA-IEF-OPEC Symposia on Energy Outlooks to enhance collective understanding of energy market outlooks through in-depth dialogue and advancing the comparability of IEA's and OPEC's energy outlooks. Thereto, IEF continues to facilitate collaboration between IEA and OPEC experts in a series of technical meetings, including the Eleventh IEA-IEF-OPEC Technical Meeting on Advancing the Comparability of Energy Outlooks that was held on 26 February 2019 in advance of the Ninth IEA-IEF-OPEC Symposium on Energy Outlooks.

Key highlights from the three sessions and main findings from both organisations' outlooks are presented in the next sections. Full presentations and IEF documents can be accessed on IEF's website at www.ief.org.

2. Opening Statements

Dr Sun Xiansheng, Secretary General of the IEF, noted that over the years the Joint Symposium on Energy Outlooks has gone from strength to strength. Comparing outlooks is now easier. Dialogue on varied producer and consumer perspectives is better informed, more collegial, and interactive as a consequence. The three key issues that concern us most today are:

1. Security of Energy Supply and Energy Market Volatility,
2. The Pace of Change and Energy Transition, and
3. New Challenges to Energy Investment

HE Khalid Al-Falih, Minister of Energy, Industry, and Mineral Resources of Saudi Arabia, and host of the IEF, highlighted that peak supply theories held only a decade ago, have given way to peak oil demand scenarios that will prove to be equally erroneous. He noted that energy transition is underway but will be long and complex, pointing at a significant difference of opinion about how the wider global energy transition will unfold in terms of its pace, scope, deployment difficulties, and difference across various regions of the world. This is especially true given the stark difference between rich nations and developing countries. "Oil and gas will continue to dominate but must become more environmental friendly. While the world will, without a doubt, need the contributions of a diverse and evolving mix of energy sources, orderly transition demands that we be cautious and avoid hasty decisions, including prematurely discontinuing investments in oil and gas. Forums like this, with the participation of the IEA, the IEF and OPEC, as well as the many respectable think tanks, offer excellent opportunities to promote consumer-producer dialogue. They also shape an environment in which well-considered and pragmatic policies flourish," he said.

OPEC's Secretary General, HE Mohammed Barkindo and IEA's Director of Energy Markets and Security, Mr. Keisuke Sadamori, noted the importance of the symposium to enhance a common understanding between IEF, the IEA and OPEC. Also noted were the three organisations' significant contributions to inform policy and investment decisions that facilitate orderly transitions to more sustainable and secure energy systems.

3. Key Findings from the Ninth IEA-IEF-OPEC Symposium on Energy Outlooks and Highlights from Recent IEA and OPEC Outlooks

OPEC and the IEA presented their short-, medium-, and long-term assessments. OPEC's focus emphasised how energy market changes affect oil markets, the IEA highlighted what energy sector transformations could help to match sustainability requirements with rapidly growing energy demand. The IEF provided an overview of the findings of the comparative analysis of the IEA and OPEC outlooks published in 2018.

While the IEA projected steady world economic growth at 3.5%, OPEC projects a decrease in the rate of growth to 3.3%. Using 2017 as a base year, both organisations projected world liquid demand and supply to surpass 100 million barrels a day (mb/d) in 2019. In the Reference Case OPEC projected oil demand to increase by 14.5 mb/d reaching 111.7 mb/d in 2040. IEA projected oil demand to grow by 11.5 mb/d to reach 110.9 mb/d in the New Policies Scenario. Oil will retain the highest share in the global energy mix throughout the projected period with 28% of total primary energy demand in 2040 as projected in OPEC's Reference Case and the IEA New Policies Scenario.

OPEC noted that oil demand growth remains healthy in 2018 and 2019 and that non-OPEC supply recovered during the same period. Notwithstanding the high level of compliance with the Declaration of Cooperation that averaged 115% over the past two years to January 2019, OECD commercial oil stocks rose. For the medium-, and long-term market outlook to 2023 and 2040 respectively, OPEC estimates global

population growth to rise from 7.6 billion in 2017 to 9.2 billion in 2040. World economic growth was expected to average 3.4% per annum to 2040, while it reflected an evolutionary development of technologies in the sensitivities to its reference case. It noted that in absolute terms natural gas would expand the most followed by renewables excluding biomass and hydro. Overall energy demand would increase by 33% to reach 365 million barrels of oil equivalent per day (mboe/d) in 2040. China and India each account for more than 20 mboe/d of this growth. While developing countries see their share in energy demand growth increase by 10% to reach 63%, their oil demand will increase by 22 mb/d, and OECD oil demand will decline by 8.7 mb/d in 2040. OPEC noted that the transportation sector remains the largest overall oil demand growth sector at +8.2 mb/d, while petrochemicals see the largest individual growth in oil demand at 4.5 mb/d over the long-term. Oil demand in road transportation is sensitive to the market penetration of electric vehicles. Though this may imply a reduction of 1 mb/d in oil demand over the next decade the range of uncertainty grows to 4 mb/d over the long-term to 2040.

OPEC projects that US tight oil will peak by the late 2020s and that demand for OPEC crude oil will grow from current levels to almost 40 mb/d by 2040. This is notwithstanding sensitivities in US tight oil production estimates that range from 1-2 mb/d in the late 2020s to 3-4 mb/d by 2040 relative to OPEC's Reference Case. In conclusion, OPEC noted that a substantial expansion of new capacity is required in the downstream sector, especially for distillation and desulphurisation. OPEC estimated cumulative oil-related investments amount to \$11 trillion up to 2040.

The IEA underscored the importance of continued improvements in energy efficiency and environmental criteria to address energy security and sustainability concerns. As a consequence oil product demand is shifting to lighter products that increase their share from 19% to 23% in the new policies scenario. This imposes new demands on refineries. Though structural changes will impact oil demand for passenger cars, other drivers for oil demand led by the petrochemical sector remain robust. The IEA noted that global oil supply relies heavily on production from the Middle East, tight oil, and deepwater projects. The IEA placed emphasis on the growing share of

renewables that raise flexibility needs and call for power sector reforms. The IEA further noted that while renewables, efficiency, and a host of innovative technologies, including Carbon Capture Use and Storage (CCUS), and hydrogen are needed to reduce emissions, governments will determine the adoption of such technologies in the future.

The IEF provided a summary of the key findings that the comparative analysis of the IEA and OPEC outlooks provided in the IEF-RFF introductory paper, which was circulated to participants in advance of the Symposium. The IEF noted that both the IEA and OPEC project world liquids demand and supply to cross the 100 mb/d threshold in 2019. Global oil demand continues to grow, though at a slightly slower pace than in recent years; IEA and OPEC project 1.4 mb/d, and 1.3 mb/d in 2019. While liquids supply assessments diverge by 0.4 mb/d in 2018 and 0.5 mb/d in 2019 largely on account of OECD Americas and the FSU, OPEC and the IEA project non-OPEC liquids supply to increase by 2.2 mb/d and 1.5 mb/d in 2019 respectively driven by OECD Americas. US tight oil has continued to surprise to the upside over the past two years but the IEA and OPEC differ on US and Canadian supply growth outlooks by 2.0 mb/d in 2023. Though OPEC projects non-OPEC production to increase by 8.6 mb/d and the IEA forecasts a rise of 5.5 m/d by 2023, the IEF noted that the alternative IEA and OPEC scenarios show hydrocarbon demand's resilience over the longer term. The IEF also highlighted that renewables' shares lie far apart, ranging from 17% to 31% across scenarios to 2040 and that security of demand weakens over the longer term as variance between baseline and alternative scenarios widens. In conclusion the IEF gave an overview of the progress made in enhancing the comparability of energy outlooks and highlighted the areas in which further advances could be made.

Symposium participants focussed on the impact of electric vehicles on oil demand, the implications of U.S. shale projections for energy market stability, and investment requirements in the petrochemical sector to accommodate changes in feedstock and lighter oil product demand.

4. Views on Short-, Medium- and Long-term Energy Outlooks from Industry and Academia

HE Yury Sentyurin, Secretary General of the Gas Exporting Countries Forum (GECF) highlighted the main findings of the GECF Global Gas Outlook in his key note address. Assuming world economic growth at 3.7% to 2025 and 3.2% from 2025 to 2040, he noted that the share of natural gas in the global energy mix would increase from 22% in 2017 to 26% in 2040 with the largest growth taking place in the transport and power generation sectors. He further highlighted the vital importance of natural gas as a clean energy source when comparing carbon dioxide emissions with oil and coal, and emphasising the role that the GECF plays in advancing natural gas in the global climate agenda. Natural gas trade will remain dominated by cross border pipelines, although the role of LNG trade will grow over projection periods. Most investment in natural gas will centre on upstream development and liquefaction capacity to 2040. He referred to the G20 Communique of the energy ministers meeting in Bariloche, Argentina that recognised the role that natural gas currently plays and its potential to expand significantly over the coming decades in support of transitions to lower emission energy systems. He also pointed to the IEF16 Concluding Statement of the energy ministers meeting in New Delhi India, noting that the GECF is ready to participate in the IEA-IEF-OPEC energy dialogue as a full partner organisation.

Invited participants from industry and academia presented their perspectives, examining key projections for energy market fundamentals. They also discussed the challenges arising from them while exploring potential solutions. Representatives from new Asian oil trade platforms noted the increasing uncertainties in oil supply and demand arising from energy sector transformations, challenges to global economic growth and greater fluctuations in energy prices. Given import dependencies of Asian Pacific countries such as China, newly emerging oil trade

platforms that improve price discovery and risk management in the international oil market can offer some solutions.

Industry panellists gave their views on energy outlooks highlighting the knowns and unknowns of future oil demand, the pace of change for renewable deployment and what needs to be done to achieve a low-carbon energy system. Oil demand and supply scenarios vary strongly over industry scenarios ranging from evolving-, to rapid transition pathways. On one hand these uncertainties negatively affect investment in both existing and new oil and gas field development. On the other hand the market penetration speed for new energy sources varies strongly across scenarios which amplifies uncertainties and raises issues of security of supply they noted. Greenhouse gas emission reduction requirements would require a rapid transition. According to industry most carbon-dioxide emission reductions would come from the power, industry, building, and transport sectors. Industry noted that contrasting fuel mixes arrived at in the rapid transition and evolving transition scenarios show primary energy demand for coal would have to drop significantly to reduce greenhouse gas emissions by 2040. Apart from renewables, gas and coal plus CCUS, energy storage and demand-side-response, hydrogen and bioenergy with CCS can provide solutions to decarbonise energy demand. Circular economy concepts and process efficiency, e.g. through waste to energy, or emissions to value as well as negative emission technologies such as afforestation and direct capture also provide new opportunities.

Representatives from independent knowledge centres gave their views on energy market developments from a Japanese and U.S. perspective. Though real economic growth rates have all but decoupled from energy demand growth in OECD economies, this is not the case for the non-OECD region that accounts for almost the entirety of net energy demand growth over the long-term. China, India and other ASEAN economies account for 63% of this increment. Asia's share in global primary energy demand will increase from 41% to 48% to 2050. While its electrification rate will reach 30% over the long-term 40% of electricity demand will be powered by coal in contrast to other regions that will see the share of natural gas grow alongside an

uptake in renewables. Alternative scenarios will see coal and oil demand decline and plateau in 2030 but high dependency on hydrocarbons continues. Additional innovation and policy initiatives are needed to keep greenhouse gas emissions within agreed thresholds. This would imply a dramatic expansion of natural gas supply to enable coal to gas switching in Asia to decarbonise the power sector.

Since 2017, the U.S. has become the largest oil and gas producer and production will continue to increase albeit at a more moderate growth rate over the 2020s. This will help to meet the energy needs of energy importing countries, shift oil and gas trade flows, and impact prices. Tight oil and shale gas production, however is not a perfect market balancer, and the short cycle investment pattern has, alongside other energy market uncertainties, reduced global upstream investment over the past five years. The increase in oil market volatility adversely impacts macro-economic development and will present a barrier to sustainable economic development if left unchecked. Panellist noted the crucial role that OPEC continues to play in reducing oil price volatility. Natural gas exports from the U.S. meanwhile have empowered market stakeholders to create a more efficient and competitive world gas market and greater export capacity and LNG volumes enhances energy security world-wide. Participants noted that the U.S. remains a co-dependent stakeholder in an ever more interconnected world energy market. New vulnerabilities arising from trade disputes and changing perceptions on the utility of strategic reserves and use of sanctions must be carefully weighed against changing market realities.

5. Session perspective: Investment and Challenges in the Petrochemical and Refining Sectors

In his key note address, Dr Ian Mead, Assistant Administrator of the U.S. Energy Information Administration gave an overview of investment and challenges in the petrochemical and refining sector to set the scene for the thematic session of the symposium. He focused on the changes resulting from the International Maritime Organisation's (IMO) fuel specifications on sulphur content that will take effect in January 2020, the development of a Hydrocarbon/Natural Gas Liquids market, and

the need to have clear well-defined data on final products and infrastructure investment for forecasting, analysis, and other purposes. The effect of the new IMO regulation that specifies a sulphur limit of 0.5% for maritime fuels as of 2020 will boost LNG and low-sulphur residual fuel oil demand as markets settle to a new equilibrium after 2020. He noted that the share of U.S. crude production in world output will remain steady while U.S. natural gas plant liquids production (NGPL) share will grow to 45% of the global total by the mid 2020s, with ethane constituting 43% of a substantially lighter barrel by 2050. He noted that NGPL growth provides a cost-advantaged feedstock to the petrochemical industry.

Industry panellists from Europe and China reaffirmed the strong market fundamentals for petrochemicals driven by population growth, growing demand for lighter weight materials, energy efficiency and recycling capabilities. While feedstock for polymer production is linked to oil, the U.S. shale oil and gas revolution have lowered feedstock prices and placed ethane and LPG at a considerable discount to Naphtha. This has enabled a considerable expansion of investment in petrochemicals production in regions with low-cost gas feedstock and high demand growth centres.

While refining capacity additions are outpacing global demand growth and leave the world with excess refinery capacity by 2025, new green field integrated complexes are more competitive and place economic pressure on older plants. As Middle East NOC's are increasing their exposure throughout the value chain to capture value and hedge against market volatility existing brownfield sites that were geared to process heavy crudes will suffer from the increased availability of light US Shale oil when unable to adjust. Relationships are evolving as a consequence of market shifts and changing product demand. This requires a holistic and agile approach to business models in the petrochemical and refining sector participants noted.

In China, refinery capacity has reached 830 million tonnes per year and China's petrochemical and refining industry still has room to improve. Improvements can arise from direction of super-scale, refinery-petrochemical integration, higher

efficiency, and intelligent development panellist noted. Though the production of China's refined oil already exceeds consumption, products still rely on oil and gas imports that in turn require further upgrading of the petrochemical and refining sector. Chinese demand growth rates for gasoline and diesel has slowed over the past decade as a consequence of new transport infrastructure investment, increases in internal combustion engine efficiencies, and policy approaches to curtail urban pollution and expand electric vehicle uptake. Globally, this trend will undergo a short but significant adjustment counteracted by the introduction of International Maritime Organisation (IMO) fuel standards that will shift fuel demand to diesel and gasoil at the expense of high sulphur fuel oil symposium participants noted.

Participants concluded that to efficiently meet demand, refineries must be better calibrated to meet a growing petrochemical demand and accommodate new feedstock opportunities. Investment is most promising in integrated greenfield sites that can profit from economies of scale, higher operating rates and refinery-petrochemical integration. Effective dialogue based on rigorous energy statistics can help to better inform investment and policy decisions to advance profitability and market stability in the refining and petrochemical sectors.

6. Conclusions

Reflecting on the key outcomes of the 2018 Outlook Symposium, the heads of IEA, IEF and OPEC found that dialogue on varied producer and consumer perspectives has become better informed throughout the years. This year's comparative analysis of the IEA's and OPEC's short-, medium-, and long-term projections was facilitated by more closely aligned baseline data. The IEA, IEF and OPEC remain committed to further strengthen joint engagement in enhancing comparability of their energy outlooks. Continued collaboration and an open dialogue are prerequisites to achieving greater data consistency and to improving understanding of discrepancies in historical data. Agreement on baselines and projection periods, as well as definitions and classifications remain essential to make IEA and OPEC forecasts more comparable. Senior experts from both organisations agreed to continue their efforts

and share baseline data and agree projection time frames for outlooks published in 2019.