



Joint IEA-IEF-OPEC Report

On the

Tenth Symposium on Energy Outlooks

19 February 2020

Riyadh | Saudi Arabia

Contents

1. Introduction
2. Opening Statements
3. Key Findings from the Tenth IEA-IEF-OPEC Symposium on Energy Outlooks and Highlights from Recent IEA and OPEC Outlooks
4. Key Stakeholder and Industry Views on Short-, Medium-, and Long-Term Energy Outlooks
5. Session Perspective: Policy and Technology Evolutions in the Road Transport sector: What are the Impacts on Energy Demand and Investment?
6. Conclusion

1. Introduction

This summary reflects the main outcomes of the Tenth 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 Organisation of the Petroleum Exporting Countries (OPEC). The symposium was held on 19 February 2020 at the IEF Headquarters in Riyadh and convened over 150 participants including ministers and other high-level industry and government representatives who gathered alongside leading experts to provide a range of insights.

HRH Prince Abdulaziz bin Salman bin Abdulaziz AL Saud, Minister of Energy, Saudi Arabia made introductory remarks on behalf of the host country of the IEF, and, alongside Dr Sun Xiansheng, Secretary General of the IEF, welcomed attendees to the IEF.

Discussions focused on the IEA and OPEC flagship outlook publications informed by the comparative analysis of insights on energy demand and supply trends outlined in the introductory paper prepared by the IEF and Resources for the Future, in consultation with the IEA and OPEC.

Dr Sun Xiansheng; Dr Kamel Ben Naceur, Chief Executive Officer, Nomadia and Former Minister of Energy of Tunisia; and Mr Mark Finley, Senior Fellow in Energy and Global Oil, Baker Institute moderated discussions that were held under the Chatham House Rule and structured in three sessions on:

1. Key findings from the Comparative Analysis on Energy Outlooks and presentations of the latest IEA and OPEC projections,
2. Key Stakeholder and Industry Views on Short-, Medium-, and Long-Term Energy Outlooks, and
3. Policy and Technology Evolutions in the Road Transport sector: What are the Impacts on Energy Demand and Investment?

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 program of the producer-consumer dialogue to enhance the understanding of energy market and policy developments. The trilateral work program 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 Cancún, 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 Energy Market Outlooks.

Substantial progress was made over the course of the previous nine IEA-IEF-OPEC Symposia on Energy Outlooks to enhance collective understanding of flagship publications through in-depth dialogue and advancing the comparability of IEA's and OPEC's outlooks. The IEF continues in its role to successfully facilitate collaboration between IEA and OPEC experts in a series of technical meetings.

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 Ayed Al Qahtani, Director, Research Division, OPEC, representing Mohammad Sanusi Barkindo, the Secretary General of the Organisation of the Petroleum Exporting Countries; Mr Keisuke Sadamori, Director, Energy Markets and Security Directorate, IEA; and Mr Tommy Joyce, Deputy Assistant Secretary, Global Energy Security and Multilateral Engagement, from the US Department of Energy opened proceedings noting the progress the Joint Symposium on Energy Outlooks has achieved for international energy cooperation and the tangible improvement in

outlook comparability. Dialogue on varied producer and consumer perspectives is better informed, more collegial, and consequently, more productive. The three key points outlined were:

1. Trends in energy supply-demand balances and subsequent volatility,
2. The transformational impact of policy and technology in transitions, and
3. New challenges for effective energy investment.

Opening remarks reaffirmed commitments to international energy market security and the need for stable transitions. Speakers drew attention to the significant difference between different outlook scenarios and the resulting future uncertainty noting the continued need for data transparency and informed policy decisions which facilitate evolving energy systems.

3. Key Findings from the Tenth 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 on world energy outlooks. OPEC emphasised how challenges of economic uncertainties are likely to persist and the role that institutional cooperation plays in meeting future energy needs. The IEA highlighted energy sector volatility and how transformations can meet sustainability goals in a world of insufficient energy access. The IEF provided an overview of the findings of the comparative analysis of the IEA and OPEC outlooks published in 2019.

It was widely noted through the symposium that much of the presentation and outlook projection work had taken place before the effects of the COVID-19 pandemic were apparent and fully accounted for.

In its short-term outlook the IEA projects 3.4 percent of global economic growth for 2020 while OPEC projects 3.0 in the same year. It was noted that these economic

projections sit in a context where energy access for all remains a hurdle to the alleviation of energy poverty and economic development. On world oil demand and supply, both organisations made projections using 2018 as a base year. OPEC projected liquids demand to increase by 0.9 mb/d to reach 100.9 mb/d in 2020. IEA estimates an increase of 1.3 mb/d, reaching a demand of 101.5 mb/d in 2020. The primary causes of disparities were found in the non-OECD Asia, with the IEA projecting Chinese demand growth 0.6 mb/d higher than OPEC projections. On the supply side, OPEC and IEA projections for global liquids production both surpass the 100 mb/d threshold in 2020 with projections of 101.5 mb/d and 100.9 mb/d respectively leaving the difference between the two organisations at 0.6 mb/d. This disparity is caused by the difference in OECD projections with the divergence for OECD Americas standing at 0.4 mb/d.

In the medium-term IEA and OPEC expect 2024 world liquids demand to reach 106.4 mb/d and 104.8 mb/d respectively, continuing the trajectory of robust growth projected in last year's outlooks from both organisations. The IEA projects a more bullish average annual growth of 1.2 mb/d compared with the 1.0 mb/d of OPEC. The primary driver of demand growth comes from the non-OECD with the IEA and OPEC projecting 1.2 mb/d and 1.1 mb/d per year respectively. In the OECD, OPEC projects liquid demand to fall 0.5 mb/d by 2024 while IEA projects a slight increase of 0.02 mb/d, reaching 47.3 mb/d and 47.9 mb/d respectively. OPEC projects demand will remain sluggish due to persistent stock surplus in the OECD. In medium term, liquids supply growth is projected to come from the non-OPEC countries with a cumulative net supply growth of 9.9 mb/d until 2024. IEA projects a smaller supply growth of 6.1 mb/d by 2024. OPEC projections show the OECD Americas making up 66 percent of non-OPEC growth with the IEA expecting 70 percent for the same figure. The projections from both organisations are upward revisions from last year, with the IEA and OPEC figures indicating differences in the underlying variables of projection models which inform both medium- and long-term projections. These differences in feed-in variables include a range of assumptions on prices, technological developments, coal phase-outs, and US shale resilience among others.

Projecting to 2040 the IEA and OPEC expect the share of fossil fuels in the energy mix to decrease in most scenarios but to increase in volumetric terms with growing demand. The IEA envisions a 74 percent fossil fuel share in its Stated Policies Scenario and a 78 percent share in its Current Policies Scenarios by 2040, showing a decrease from the 2018 baseline year of 81 percent. OPEC's Reference Case Scenario projects 75 percent fossil fuel share with oil remaining the largest fuel source by percentage across the above three scenarios. IEA world liquid demand reaches 112.9 mb/d and 124.6 mb/d in the Stated Policies and Current Policies Scenarios respectively by 2040, showing an average annual growth of 0.6 mb/d and 1.1 mb/d. Meanwhile OPEC Reference Case Scenario projects world liquids at 110.6 mb/d and a growth of 0.5 mb/d. In IEA's Sustainable Development scenarios and OPEC's Below 2°C Scenario oil is the second-largest fuel source making 23 percent and 17 percent of the IEA and OPEC energy mixes respectively. In 2040, world energy supply is projected at 357.5 mboe/d under OPEC's Reference Case Scenario, and 387.4 mboe/d under the IEA Current Policy Scenario. Energy demand projections fall to 261.7 mboe/d and 268.2 mboe/d under OPEC's Below 2°C Scenario and the IEA Sustainable Development Scenario, respectively.

Most forecasts project a reshaping of the energy landscape with a rapid rise in electricity consumption and advances in storage and renewable technologies. The reductions in Solar PV costs and improvements in efficiency mean that Solar PV is projected to surpass natural gas in the mid 2030's, to have the largest share in global power capacity according to the IEA Stated Policies Scenario. However, development and integration of this and other end-use energy technologies, despite price reductions, remains policy sensitive. Similarly, the development and support of Carbon Capture Utilisation and Storage (CCUS) to meet climate goals and demand growth requirements can facilitate the repurposing of some of the 2250 GW of coal generation capacity now existing or under construction. CCUS to retrofit and/or repurpose coal-fired capacity has a clear application to ensure a young Asian coal fleet can meet goals of reduced pollution and emissions.

The transitions upcoming in the next 20 years will require investment, in a more diverse energy mix, but this also means supporting investment in conventional oil and gas production to meet long-term demand. OPEC emphasised the need for long-term upstream investment Capex amounting to 10.6 trillion USD by 2040 with an average of \$370 billion USD needed in the upstream sector each year to meet future demand and avoid excessive volatility. The IEA noted a large-scale uptake of varying forms of natural gas in non-OECD Asia as coal-to-gas switching increases. This projection coupled with the ambiguity over the future penetration of CCUS mean that non-OECD Asia coal usage and climate goals will depend on technological maturation and the extent of natural gas penetration. Changes in non-OECD consumption will see Africa emerge as a key driver for global energy markets, with the continent's rapid increases in wealth, urbanisation, and population marking a new and important vector in the world's renewable energy development, particularly in the development of Solar PV and its viability as a leapfrog technology. Both organisations referenced the uncertainty of Electric Vehicle (EV) growth as the single biggest vector in the determination of future oil demand with variations of circa 200 percent between scenarios. At present, road transport makes up around 40 percent of oil demand, with half of the growth from 2000 to 2020 coming from developing economies. The pace and scale of non-Internal Combustion Engine (ICE) vehicle uptake is signaled by its growth in Non-OECD as well as OECD countries and will likely need to be accompanied by grid solutions which will facilitate large-scale electrification and storage.

4. Key Stakeholder and Industry Views on Short-, Medium-, and Long-Term Energy Outlooks

On behalf of HE Yury Sentyurin, Secretary General of the Gas Exporting Countries Forum (GECF), Mr Dmitry Sokolov, Head of Energy Economics and Forecasting at GECF highlighted the main findings of the GECF Global Gas Outlook in his keynote address. Assuming world economic growth at 3.0 percent-3.2 percent to 2025, and 3.2 percent to 2050, he noted that the share of natural gas in the global energy mix

would increase from 23 percent in 2018, to 27 percent in 2050, with the largest growth by share taking place in the transport and power generation sectors. He further highlighted the vital importance that natural gas plays in meeting national and international emissions goals as compared to oil and coal that have larger CO₂ and particulate emissions. Natural gas trade will remain dominated by cross border pipelines until 2025 with only a slight reduction in share, however the role of LNG trade will grow over projection periods to make up just under half of the global gas trade by 2050, a trade increase of 85 percent from 2018 to 2050. Most investment in natural gas will centre on upstream development capacity to 2050 with total investment amounting to 9.7 trillion USD to feed the projected 1200 bcm increase in “Yet To Find” production. He referred to the G20 Ministerial Meeting on Energy Transitions and Global Environment for Sustainable Growth hosted in Japan which recognised the increasing role natural gas can play in the shift towards lower emissions systems. Mr Sokolov also highlighted GECF engagement with the Joint Organisations Data Initiative (JODI) and the IEF, pointing to the partnerships that the IEF shares with a multitude of diverse organisations to facilitate energy dialogue and data transparency.

Industry panelists then presented their perspectives and examined key projections for energy market fundamentals. They also discussed common challenges and explored potential solutions. It was noted that, given growing demand, the slowing LNG capacity additions potentially lead to a tightened market in the late 2020's. Attention was drawn to three key factors that will lead to increase gas demand, namely: the cost competitiveness of gas over oil, the environmental competitiveness of gas over coal, and the grid security competitiveness of gas over renewables. These three factors will make the primary drivers for increased gas consumption in Europe, India, China, and the US with economies incentivised by varying degrees by environmental, cost, and security goals.

Speakers also 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. Panelists deliberated

upon the strong variation in scenarios including current-, accelerated-, 2°C- and evolving scenarios, noting the key drivers of technologies, government policies and consumer trends. The energy future projected indicates that investment in oil will remain necessary to meet demand and will be required, even in the most rapid energy transitions. The market penetration speed for new energy sources varies strongly across scenarios which amplifies uncertainties and raises issues of security of supply. Panelists noted that there must be a concerted effort on behalf of all to meet the world's growing energy needs, affordably, and equitably. In addition to, and complementary with current energy sources, CCUS can facilitate a cleaner and more energy secure transition by developing energy storage and demand-side response. The development of grey-, blue- and green hydrogen in addition to bioenergy will complement CCUS to provide solutions to decarbonise energy demand, expand electrification, and improve system reliability.

Speakers representing national knowledge centres gave their views on energy market developments focusing on trends in Saudi Arabia, Russia, and the United Arab Emirates. Analysis presented on the Gulf economies showed exports, revenue and GDP has diversified substantially through government visions and programs. The program, instituted in the Kingdom of Saudi Arabia, has increased non-oil revenue by circa 30 percent since 2012 through development in manufacturing, mining, and diversified energy sources. Energy efficiency improvements will likely exceed GDP growth leaving the energy market more flexible, and Gulf states more divested from oil. Presentations on energy perspectives from the Russian Federation echoed earlier outlook conclusions noting the rapid growth in renewables but recognising the continued need for fossil fuels. It was reiterated that in times of transition there is a high level of uncertainty which investment decisions are exposed to potentially leading to inadequate investment and future volatility. When discussing transitions, panelists described how the diverse set of possible futures should encourage both producers and consumers to build for flexibility in energy systems. This flexibility should include differences in how we will use energy in the next 20 years. It was noted that the use of battery-powered devices has expanded dramatically along with the growth of the millennial generation. This age bracket now makes up the largest

US demographic group, and the future driver of energy demand will remain centered around their consumer choices.

5. Session perspective: Policy and Technology Evolutions in the Road Transport sector: What are the Impacts on Energy Demand and Investment?

In his keynote address, Mr Francesco La Camera, Director-General of the International Renewable Energy Agency (IRENA) gave an overview of policy and technology developments in the transport sector focusing on biofuels and power demand. At present 92 percent of transport fuel comes from oil products, 3 percent comes from biofuels and the remainder comes from electricity. The future is expected to see further decarbonisation. Under IRENAs Renewable Energy Roadmap renewables will make up 57 percent of the transport sector, this includes a wide role out of a range of vehicles with varying integrals of electrification, in addition to a growth in the use of hydrogen fuel cells for freight modules, and a 37 percent share in biofuels for direct use. Digitalisation will also change transport with sharing mobility eventually transforming the use of a car into a service as opposed to an asset. Although complete vehicle autonomy remains on the more distant end of projections, increasing use of AI, big data, and machine learning will revolutionise efficiency, safety and cost, to service an expanding transport activity projected at 75 percent by 2050 according to IRENA. The growth in the transport sector will shift from today's split of 45 percent OECD and 55 percent non-OECD; to 28 percent OECD and 72 percent non-OECD by 2050 and to regions where power generation demand is also growing. This marks an opportunity to pair two non-OECD growth needs by integrating electrification, including EVs, with renewable generation. The effect of EVs on a grid system is that they cause a relatively low impact on overall grid demand but a higher impact on peak load. By facilitating the dual growth of end-use generation and electrification, the expansion of smart charging and storage can reduce curtailment while allowing higher system shares of low-cost solar and wind electricity at times of peak generation. Similar concepts can be applied to hydrogen storage where facilitating the simultaneous integration of electrification,

storage, and renewable power generation has an opportunity to meet non-OECD demand growth through an investment approach that caters for, new power generation, grid loads, and increased electricity consumption.

Panelists from Saudi Aramco and King Abdullah Petroleum Studies and Research Centre (KAPSARC) emphasised the importance of efficiency in meeting future demand. Rapid growth in the fuel economy of ICE vehicles is projected to reduce CO₂ output of the largest oil consuming sector while maintaining cost effectiveness of car ownership. Cars with smaller engines and fewer cylinders to enhance combustion, new composites for weight reduction, and engine management software are some of the technology improvements that will characterise the future penetration of ICE vehicles. It was noted that the present investment trends, favour efficiency improvements of ICE vehicles, however, it is projected that investment will shift towards technologies which support mass vehicle electrification. The transition to electric and other non-ICE vehicle will be driven by policy, technology, consumer preferences, and investment. The collective change of these variables will decide the pace of transition from the mixed power trains scenario into a largely non-ICE vehicle transportation sector.

In a future of increased access to transport, particularly in non-OECD countries, input fuel type will change to host an increased share of biofuels with most regions setting targets to biofuel concentrations. Building on those already set, China is planning a 10 percent countrywide mandate in 2020, while India is aiming for an ethanol blending target of 10 percent by 2022. Discussions also drew attention to aviation and shipping sectors noting the refinery breakdown of product extraction from a barrel of crude is relatively inflexible and will face configuration and price challenges when seeking to meet the demands of NGL, gasoline, and petrochemical products. Poorly calibrated refineries may generate a surplus of bottom products and send perverse price signals creating price incentives for higher emission products. The continued growth in oil demand for transport will also be shaped by the reality that not all oils are equal when it comes to transport and that there are significant

disparities in well head to use emissions of different crude types. Future demand will likely have a higher premium on lower carbon oil to meet low-cost transport growth in non-OECD countries and oil demand in general. This will depend on a well-calibrated downstream sector and sustained investment in lower carbon oil production.

6. Conclusions

Reflecting on the key outcomes of the 2020 Outlook Symposium, the heads of IEA, IEF and OPEC found that dialogue on varied producer and consumer perspectives has become better informed as a consequence of enhanced dialogue on the platform that the IEF provides. This year's comparative analysis of the IEA's and OPEC's short-, medium-, and long-term projections showed more closely aligned and transparent baseline data. The IEA, IEF and OPEC restated their commitment to further strengthen joint engagement in enhancing energy outlook comparability in pursuit of a more informed decision making. Continued collaboration and an open dialogue are prerequisites to achieving greater data quality and to improving understanding of discrepancies in methodology and historical data. Senior experts from both organisations agreed to continue their efforts and share baseline data and agree to projection time frames for further outlooks publications.